Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY	Application number	Legal land description
☐ Approval ☐ Registration ☑ Authorization ☐ Amendment	FA24001	SEC 32-74-22 W5

APPLICATION DISCLOSURE

This information is collected under the authority of the *Agricultural Operation Practices Act* (AOPA), and is subject to the provisions of the *Freedom of Information and Protection of Privacy Act*. This information is public unless the NRCB grants a written request that certain sections remain private.

Any construction prior to obtaining an NRCB permit is an offence and is subject to enforcement action, including prosecution.

I, the applicant, or applicant's agent, have read and understand the statements above, and I acknowledge that the information provided in this application is true to the best of my knowledge.

June 21, 2024
Date of signing

[redacted]
Signature

Homeland Hutterian Brethren
Corporate name (if applicable)

Simeon Wipf
Print name

GENERAL INFORMATION REQUIREMENTS

Proposed facilities: list all proposed confined feeding operation facilities and their dimensions. Indicate whether any of the proposed facilities are additions to existing facilities. (attach additional pages if needed)

Proposed facilities	Dimensions (m) (length, width, and depth)
Expand EMS	76.2 x 41 x 4.6
Total dimensions:	76.2 m x 86.7 m x 4.6 m

Existing facilities: list **ALL** existing confined feeding operation facilities and their dimensions

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
See attached		

NRCB USE ONLY

Confirmed. Existing CFO

Last updated September 11, 2023

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY	Application number	Legal land description
☐ Approval ☐ Registration ☐ Authorization ☐ Amendment		

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I, the applicant, or applicant's agent, have read and understand the statements above, and I acknowledge that the information provided in this application is true to the best of my knowledge.

Date of signing

Signature

Corporate name (if applicable)

Print name

GENERAL INFORMATION REQUIREMENTS

Proposed facilities: list all proposed confined feeding operation facilities and their dimensions. Indicate whether any of the proposed facilities are additions to existing facilities. (attach additional pages if needed)

Proposed facilities	Dimensions (m) (length, width, and depth)

Existing facilities: list **ALL** existing confined feeding operation facilities and their dimensions

Existing facilities	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
Dairy barn	129.235 x 37.795	
Beef feedlot pen's	121.9 x 24.4	
Beef feedlot shelter	121.9 x 15.2	

NRCB USE ONLY

Confirmed all facilities

Last updated February 26, 2021

Part 2 — Technical Requirements

NRCB | Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

Existing facilities continued	Dimensions (m) (length, width, and depth)	NRCB USE ONLY
Layer barn	75.6m X 16.5m	
Pullet barn	68.3m X 18.3 in	
Solid manure storage for layer barn	15.2m x 16.5 x 2.0	
Work area for layer barn	32.4m x 18m	
Solid manure storage for pullet barn	11.3m X 14m	
Two turkey finish barns	each 112.8m X 21.4m	
Turkey brooder barn	61m X 21.4m	
Dairy earthern manure storage	76.2m X 45.7m x 4.6m	
mixed poultry barn	27m x 21m	

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

If a new facility is replacing an old facility, please explain what will happen to the old facility and when. ☐ **N/A**

Construction completion date for proposed facilities FALL 2025

Additional information

No change in livestock numbers

Livestock numbers: Complete only if livestock numbers are different from what was identified in the Part 1 application. Note: if livestock numbers increase in your Part 2 application, a new Part 1 application must be submitted which may result in a loss of priority for minimum distance separation (MDS).

Livestock category and type (Available in the Schedule 2 of the Part 2 Matters Regulation)	**Permitted number**	**Proposed increase or decrease in number (if applicable)**	**Total**

Last updated September 11, 2023

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

DECLARATION AND ACKNOWLEDGMENT OF APPLICANT CONCERNING *WATER ACT* LICENCE

issued by Alberta Environment and Protected Areas (EPA) for a confined feeding operation (CFO)

Date and sign one of the following four options

OPTION 1: Applying through the NRCB for both the AOPA permit and the *Water Act* licence

I **DO** want my water licence application coupled to my AOPA permit application.

Signed this ____day of _____, 20____. _____

Signature of Applicant or Agent

OPTION 2: Processing the AOPA permit and *Water Act* licence separately

1. I (we) acknowledge that the CFO will need a new water licence from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. I (we) request that the NRCB process the AOPA application **independently of** EPA's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by EPA as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to EPA's consideration of whether to grant the *Water Act* licence application.
5. I (we) acknowledge that any such construction or livestock populating will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.
7. **Provide:** Water licence application number(s) _____

Signed this ____ day of _____, 20____. _____

Signature of Applicant or Agent

OPTION 3: Additional water licence not required

1. I (we) declare that the CFO will not need a new licence from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. **Provide**: Water license number(s) or water conveyance agreement details _____

Signed this 21 day of June, 2021. [redacted]

Signature of Applicant or Agent

OPTION 4: Uncertain if *Water Act* licence is needed; acknowledgement of risk (for existing CFOs only)

1. At this time, I (we) do not know whether a new water licence is needed from EPA under the *Water Act* for the development or activity proposed in this AOPA application.
2. If a new *Water Act* licence is needed, I (we) request that the NRCB process the AOPA application **independently of** EPA's processing of the CFO's application for a water licence.
3. In making this request, I (we) recognize that, if this AOPA application is granted by the NRCB, the NRCB's decision will not be considered by EPA as improving or enhancing the CFO's eligibility for a water licence under the *Water Act*.
4. I (we) acknowledge that any construction or actions to populate the CFO with additional livestock pursuant to an AOPA permit in the absence of a *Water Act* licence will **not** be relevant to EPA's consideration of whether to grant my *Water Act* licence application, if a new water licence is needed.
5. I (we) acknowledge that any such construction or livestock increase will be at the CFO's sole risk if the *Water Act* licence application is denied or if the operation of the CFO is otherwise deemed to be in violation of the *Water Act*. This risk includes being required to depopulate the CFO and/or to cease further construction, or to remove "works" or "undertakings" (as defined in the *Water Act*).
6. **AS RELEVANT:** I (we) acknowledge that the CFO is located in the South Saskatchewan River Basin and that, pursuant to the *Bow, Oldman and South Saskatchewan River Basin Water Allocation Order* [Alta. Reg. 171/2007], this basin is currently closed to new surface water allocations.
7. **Provide**: Water license number(s) or water conveyance agreement details _____

   _____

Signed this _____ day of _____, 20____. _____

Signature of Applicant or Agent

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

GENERAL ENVIRONMENTAL INFORMATION

(complete this section for the worst case of the existing facility which is the closest to water bodies or water wells and for each of the proposed facilities)

Facility description / name *(as indicated on site plan)*

Existing: Turkey Barn **Proposed 1:** EMS

Proposed 2: _____ **Proposed 3:** _____

Facility and environmental risk information		Facilities				NRCB USE ONLY	
		Existing	Proposed 1	Proposed 2	Proposed 3	Meets requirements	Comments
Flood plain information	What is the elevation of the floor of the lowest manure storage or collection facility above the 1:25 year flood plain or the highest known flood level?	☑ >1 m ☐ ≤ 1 m	☑ >1 m ☐ ≤ 1 m	☐ >1 m ☐ ≤ 1 m	☐ > 1 m ☐ ≤ 1 m	☑ YES ☐ NO ☐ YES with exemption	Not in flood plain
Surface water information	How many springs are within 100 m of the manure storage facility or manure collection area?	0	0			☑ YES ☐ NO ☐ YES with exemption	Confirmed
	How many water wells are within 100 m of the manure storage facility or manure collection area?	0	0			☑ YES ☐ NO ☐ YES with exemption	Confirmed
	What is the shortest distance from the manure collection or storage facility to a surface water body? (e.g., lake, creek, slough, seasonal)	200 M	200 M			☑ YES ☐ NO ☐ YES with exemption	None near proposed
Groundwater information	What is the depth to the water table?		6.8			☑ YES ☐ NO ☐ YES with exemption	Confirmed
	What is the depth to the groundwater resource/aquifer you draw water from?	45.72	45.72			☑ YES ☐ NO ☐ YES with exemption	Meets requirements ID 397936

Additional information (attach supporting information, e.g. borehole logs, records, etc. you consider relevant to your application)

Part 2 — Technical Requirements

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY

ENVIRONMENTAL RISK SCREENING INFORMATION

ERST for **proposed** facilities

Facility	Groundwater score	Surface water score	File number
EMS			FA09003A

ERST for **existing** facilities

Facility	Groundwater score	Surface water score	File number
Existing facilities	Low	Low	FA09003A

ERST related comments:

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY

WATER WELL AND SURFACE WATER INFORMATION

Well IDs: ID 1665907, ID 1665908, ID 1668909, ID 397936

Surface water related concerns from directly affected parties or referral agencies: ☐ YES ☑ NO

Groundwater related concerns from directly affected parties or referral agencies: ☐ YES ☑ NO

Water wells ☑ N/A

If applicable, exemption for 100 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

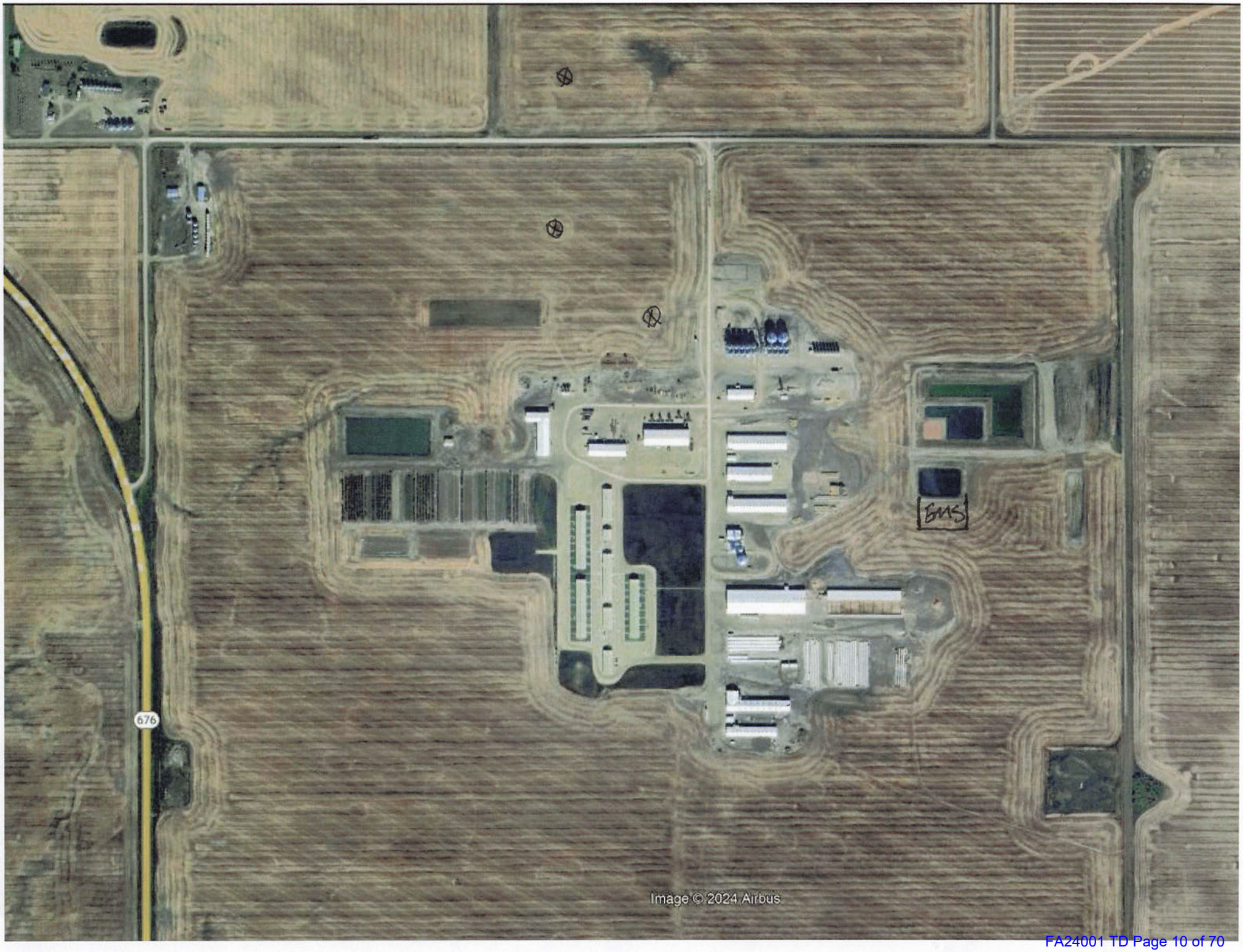
Surface water ☑ N/A

If applicable, exemption for 30 m distance requirements applied: ☐ YES ☐ NO Condition required: ☐ YES ☐ NO

Water Well Exemption Screening Tool ☑ N/A

Water Well ID	Preliminary Screening Score	Secondary Screening Score	Facility

Groundwater or surface water related comments:


676
BMS
Image © 2024 Airbus

Part 2 — Technical Requirements

NRCB Natural Resources Conservation Board

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

DISTANCE OF ANY MANURE STORAGE FACILITY (EXISTING OR PROPOSED) TO NEIGHBOURING RESIDENCES

	Neighbour name(s)	Legal land description	Distance (m)	NRCB USE ONLY: Zoning (LUB) category	MDS category (1–4)	Distance (m)	Waiver attached (if required)	Meets regulations
1	Cote, Norman Joseph	SW 4-75-22-W5	1035	AG	Cat 1	1617 m		Y
2	JLG Farms Ltd	NE 5-75-22-W5	1925	AG	Cat 1	2113 m		Y
3	Cote; Ray - Irene	NE 36-74-23-W5	2635	AG	Cat 1	2631 m		Y
4	Cote Farms Ltd	SE 36-74-23-W5	2635	AG	Cat 1	2703 m		Y

LAND BASE FOR MANURE AND COMPOST APPLICATION (complete only if an increase in livestock or manure production will occur)

Name of land owner(s)*	Legal land description	Usable area** (ha)	Soil zone ***	NRCB USE ONLY: Usable area (ha)**	Agreement attached (if required)
Homeland Colony	32-74-22 W5M	854	grey wooded		
			Total		

Applicant has provided adequate land base

* If you are not the registered landowner, you must attach copies of land use agreements signed by all landowners.

** Available manure spreading area (excluding setback areas from residences, common bodies of water, water wells, etc. as identified in Agdex 096-5 Manure Spreading Regulations)

*** Brown, dark brown, black, grey wooded, or irrigated

Additional information (attach any additional information as required)


744
676
676
1
3
4
Image © 2022 Maxar Technologies
Image © 2022 CNES / Airbus
Enilda

Part 2 — Technical Requirements

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY

MINIMUM DISTANCE SEPARATION

Methods used to determine distance (if applicable): Google earth

Margin of error (if applicable): N/A

Requirements (m): Category 1: 769 m Category 2: 1025 m Category 3: 1281 m Category 4: 2050 m

Technology factor: ☐ YES ☑ NO

Expansion factor: ☐ YES ☑ NO

MDS related concerns from directly affected parties or referral agencies: ☐ YES ☑ NO

LAND BASE FOR MANURE AND COMPOST APPLICATION

Land base required: _____

Land base listed: Applicant has provided adequate land base

Area not suitable: _____

Available area _____ Requirement met: ☐ YES ☐ NO

Land spreading agreements required: ☐ YES ☐ NO

Manure management plan: ☐ YES ☐ NO If yes, plan is attached: ☐

PLANS

Submitted and attached construction plans: ☑ YES ☐ NO

Submitted aerial photos: ☑ YES ☐ NO

Submitted photos: ☐ YES ☑ NO

GRANDFATHERING

Already completed: ☐ YES ☐ NO ☑ N/A

If already completed, see _____

Part 2 — Technical Requirements

Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area, and/or manure storage facility(ies)

NRCB USE ONLY

ALL SIGNATURES IN FILE ☑ YES ☐ NO

DATES OF APPROVAL OFFICER SITE VISITS

June 21, 2024	

CORRESPONDENCE WITH MUNICIPALITIES AND REFERRAL AGENCIES

Date deeming letters sent: June 24, 2024

Municipality: M.D. of Smoky River

☑ letter sent ☑ response received ☑ written/email ☐ verbal ☐ no comments received

Alberta Health Services: N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Alberta Environment and Parks: ☐ N/A

☑ letter sent ☐ response received ☐ written/email ☐ verbal ☑ no comments received

Alberta Transportation: ☑ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Alberta Regulatory Services: ☑ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Other: _____ ☐ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Other: _____ ☐ N/A

☐ letter sent ☐ response received ☐ written/email ☐ verbal ☐ no comments received

Part 2 — Technical Requirements

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Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area and/or manure storage facility(ies)

LIQUID MANURE STORAGE: Earthen manure storage (EMS): Naturally occurring protective layer

*(complete a copy of this section for **EACH** proposed earthen liquid manure storage facility with a naturally occurring protective layer)*

Facility description / name *(as indicated on site plan)*

1. EMS
2.

Manure storage capacity *(complete a separate row of this table for each cell of the EMS)*

	Length (m)	Width (m)	Total depth (m)	Depth below ground level (m)	Slope run:rise			NRCB USE ONLY	
					Inside end walls	Inside side walls	Outside walls	Calculated storage capacity (m^3) (excl. 0.5 m freeboard)	Filled in lower ¼? Y/N
1.	76.2	41	4.6	4	3	3	4	6,624m3	Y
2.									
							TOTAL CAPACITY	18,035 m3	

Total capacity of complete EMS

Surface water control systems

Describe the run-on and runoff control system

Berm around EMS

Naturally occurring protective layer details

Thickness of naturally occurring protective layer	15.4 (m)	Provide details (as required)	
Soil texture	22.5 % sand	33 % silt	41 % clay
Hydraulic conductivity - naturally occurring protective layer	Depth and type of soil tested: clay	Hydraulic conductivity (cm/s): 3.73 x 10-9	Describe test standard used: insitu

Additional information *(attach copies of soil test reports)*

NRCB USE ONLY

Requirements met: ☑ YES ☐ NO

Condition required: ☑ YES ☐ NO

Report attached: ☑ YES ☐ NO

Part 2 — Technical Requirements

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Application under the *Agricultural Operation Practices Act* for a confined feeding operation, manure collection area and/or manure storage facility(ies)

NRCB USE ONLY

Liquid manure storage volume calculator attached: ☑ YES ☐ NO

Depth to water table: >6 m Requirements met: ☑ YES ☐ NO

Depth to uppermost groundwater resource: 45.72 m Requirements met: ☑ YES ☐ NO

Comments:

ERST completed: ☐ see ERST page for details N/A

Surface water control systems

Requirements met: ☑ YES ☐ NO Details/comments:

Berm around EMS

Naturally occurring protective layer details

Layer specification comments (e.g. description of the layer texture, layer thickness/depth and the methodology used to collect this information such as sand lenses, number, and location of boreholes):

3.73 x 10-9 insitu test. Clay extend beyond 20 m depth

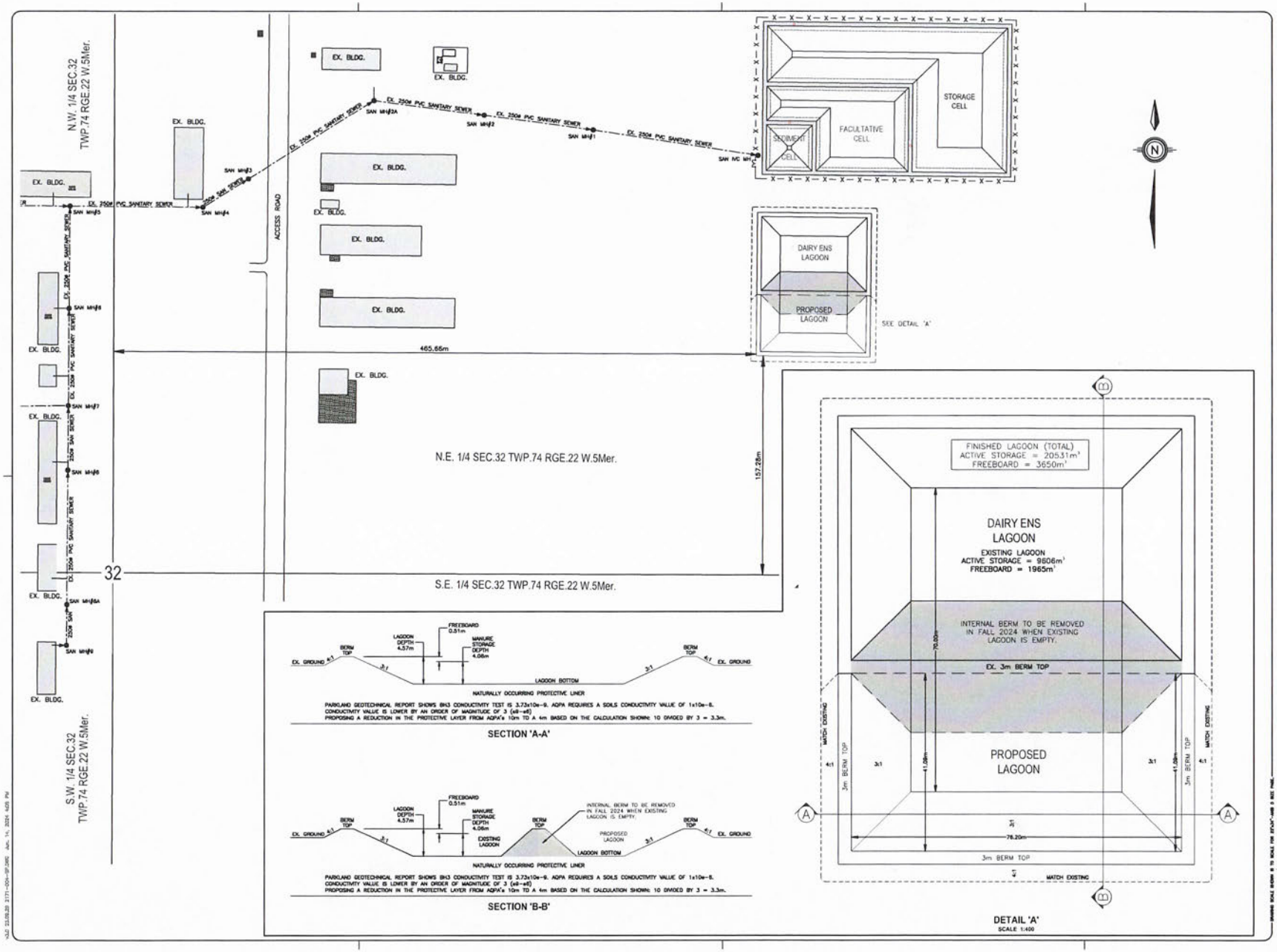
Leakage detection system required: ☐ YES ☑ NO If yes, please explain why.

NRCB USE ONLY

LIQUID MANURE STORAGE VOLUME CALCULATOR (if applicable)

Facility 1	
Name / description EMS	Capacity 18,035 m3
Facility 2	
Name / description	Capacity
Facility 3	
Name / description	Capacity
Facility 4	
Name / description	Capacity

TOTAL CAPACITY	18,035 m3
REQUIRED 9 MONTH STORAGE CAPACITY	6,390 m3
MEETS THE REQUIREMENTS FOR A MINIMUM OF 9 MONTHS STORAGE	☑ YES ☐ NO



HELIX Engineering Ltd.

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GRANDE PRAIRIE, AB.
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NOT FOR CONSTRUCTION

REVISION				
REV.	DESC.	DATE	BY	APPD.
1.	ISSUED FOR REVIEW	JUNE14/24	GWA	RJG

CLIENT:
HOMELAND COLONY FARMING COMPANY

PROJECT:
PROPOSED LAGOON SITE PLAN

LOCATION:
N.E.1/4 SEC.32 TWP.74 RGE.22 W.5 M.

PROJECT NO.:	2171-004		
DESIGN:	RJG	DRAWN:	GWA
CHK'D:	RJG		
DATE:	JUNE 12/24	BM:	

SCALE 1:1250
30 10 0 10 30 50

DRAWING: 2171-004-SP

PAGE: 01 OF 01

Environmental Geotechnical and Materials Engineering
Red Deer • Sherwood Park • Grande Prairie • Airdrie • Peace River

GEOTECHNICAL INVESTIGATION
PROPOSED MUNICIPAL SEWAGE LAGOON

HOMELAND HUTTERITE COLONY - NE 32-74-22-W5M
MD OF SMOKY RIVER, ALBERTA

PREPARED FOR

HOMELAND HUTTERITE COLONY

MD OF SMOKY RIVER, ALBERTA

PREPARED BY

PARKLAND GEOTECHNICAL LTD.

GRANDE PRAIRIE, ALBERTA

Parkland GEO

PROJECT No.: GP1758

DATE: January 12, 2011

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FIGURES

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APPENDICES

1.0 INTRODUCTION

A new municipal sewage lagoon is being proposed at The Homeland Hutterite Colony located within the NE 32-74-22-W5M, in the Municipal District Smoky River, Alberta. Parkland Geotechnical Ltd. (ParklandGEO) was commissioned to undertake a geotechnical investigation for this project. The scope of the approved work was provided in Parkland's proposal letter dated July 14, 2010 (File PRO-GP10-068). Authorization to proceed with this investigation was given by Simian Wipf of the Homeland Hutterite Colony by returning a signed copy of the professional services agreement.

The proposal outlined a basic geotechnical program for this type of development. This geotechnical report summarizes the soil and groundwater conditions and provides geotechnical recommendations with respect to design and installation of the proposed sewage lagoons and underground service trunks for the project. The site and soil conditions were assessed based on guidelines set forth in Alberta Environment's "Design and Construction of Liners for Municipal Wastewater Stabilization Ponds".

2.0 SITE & PROJECT DESCRIPTION

The proposed sewage lagoon site is located on the central east side of NE 32-74-22-W5M, in the Municipal District of Smoky River, Alberta. The location of the site is shown on the Area Plan, Figure 1 in Appendix A. Access to the lagoon site is from Highway 676 onto Township Road 750.

The topography of the proposed lagoon site was relatively level with a gradual slope towards the east and northeast. The surveyed ground elevations ranged from 578.33 to 578.90 m at the borehole locations. The surrounding area was partially developed at the time of investigation. Several buildings, barns, shops and storage bins had already been constructed. The vegetation on the site and surrounding areas consisted of agricultural crops. Wabatanisk Creek, located approximately 900 m east of the lagoon site, is a tributary of Smoky River and is located approximately 7.5 km northeast of the proposed lagoon location.

The proposed development consists of a sewage lagoon with dimensions of about 142 by 104 m. The layout of the proposed lagoon is shown on the Site Plan Figure 2, in Appendix A. The design configuration includes a 8,400 m^2 storage cell, 3,600 m^2 facultative cell and a 400 m^2 sediment cell. Based on preliminary information, the bottom floor elevations of the individual cells will range from 574.90 to 576.50 m. The inlet of the lagoon will be on the west side of the site approximately 42 m north of the southwest corner. It is proposed that outgoing effluent will be discharged by pumping out of a manhole structure.

3.0 FIELD AND LABORATORY PROGRAMS

On June 15, 2010, five boreholes, ranging in depth from 8 to 20 m deep, were drilled at the locations shown on Figure 2. The drilling was conducted using a track-mounted, continuous flight, 150 mm diameter, solid-stem auger drill, operated by Frontier Enviro-Drilling Ltd. Supervision of the drilling, soil sampling, and logging of the various soil strata was performed by Ms. Izabela Matyka, E.I.T. of ParklandGEO.

All samples were examined in the field and classified using the Modified Unified Soil Classification System. Disturbed samples for moisture content were obtained at depths intervals of 1.0 m in all boreholes. Undisturbed samples were collected at selected depths in each borehole. A slotted, 50mm diameter PVC standpipe was installed in all boreholes. The groundwater conditions were noted during drilling, on completion of drilling and again on July 28, August 6 and September 22. On July 26 and August 6, 2010, ins-itu hydraulic conductivity testing was undertaken. The groundwater level in the piezometer casing was instantaneously raised by lowering displacement weight or "slug" into the groundwater and the dropping water level was measured over time until the original groundwater level was established. Boreholes locations were later surveyed by Focus Corporation and referenced to a geodetic elevation.

All soil samples were returned to ParklandGEO's laboratory for selected testing to determine the soil properties. The laboratory program consisted of moisture contents, Atterberg Limits, Particle Size Analysis (Hydrometer Test) and water soluble sulphate concentrations. Hydraulic Conductivity testing on one undisturbed sample was conducted in ParlandGEO's Sherwood Park lab. The results of all laboratory testing are shown on the borehole logs.

4.0 SUBSURFACE CONDITIONS

The soil profile consisted of silty clay overlying clay till. The soil profile was considered to be typical for the area. Detailed descriptions of the soil conditions encountered are provided on the borehole logs in Appendix A along with the definitions of the terminology and symbols used on the logs.

4.1 CLAY

Clay was encountered in all boreholes from surface to a depth of 1.5 m. The clay contained some silt, was stiff to very stiff, medium to high plastic and moist. Atterberg Limit testing, which indicates soil plasticity and is used to assess swell potential showed an average Liquid Limit (LL) of 63 percent and a Plastic Limit (PL) of 17.5 percent. Based on two grain size analysis, the average soil texture of the clay was 66 percent clay, 17 percent silt and 17 percent sand. The moisture content in the clay ranged from 14.5 to 25.3 percent which ranges from slightly below to slightly above the estimated Optimum Moisture Content (OMC).

The high plastic clay deposits (LL>50 percent) are considered to have a significant potential for swelling and shrinking with changes in soil moisture content.

4.2 CLAY TILL

Clay till was found in all boreholes beneath the clay layers; and extended to below to the depths drilled. The till was a mixture of silt and clay with some sand, was very stiff to hard, medium plastic and moist. The average Liquid Limit was 42.4 percent, while the average Plastic Limit was 12.0 percent. Based on a grain size analysis of eight samples, the average soil texture of the clay till was 43 percent clay, 33 percent silt and 24 percent sand. The moisture content in the clay till ranged from 15.8 to 19.2 percent which is at or slightly above OMC.

4.3 GROUNDWATER CONDITIONS

4.3.1 Groundwater Measurement

Groundwater seepage was not observed in any of the boreholes during or after drilling. The following table summarizes the groundwater data.

TABLE 1
GROUNDWATER MONITORING DATA

Bore-hole	Depth of Well (m)	Ground Elev. (m)	Groundwater Depth (mbg)			
			Completion	July 28/10	Aug 6/10	Sept 22/10
1	9	578.9	Dry	Dry	Dry	Dry
2	11	578.81	Dry	Dry	Dry	Dry

3	8	578.42	Dry	6.77	6.8	6.92
4	10.5	578.33	Dry	9.73	9.47	10.28
5	19.5	578.59	Dry	Dry	19.3	18.84

The static groundwater table could not be determined based on the data that was collected. Perched groundwater water conditions were encountered in Boreholes 3, 4 and 5. Although not encountered during drilling, review of local water well records indicate that the local bedrock is at a depth of 40 m.

Groundwater levels will fluctuate seasonally at this site and will be highest after periods of snow-melt and prolonged or heavy precipitation.

4.3.2 Groundwater Flow

Based on the readings from the groundwater monitoring wells, perched water conditions were present at this site and therefore groundwater flow was not able to be accurately determined. The vertical gradient of groundwater is considered to be downward to the bedrock.

4.3.3 Hydraulic Conductivity

The hydraulic conductivity (k) of the native soil profile was determined by one laboratory test on undisturbed Shelby tube samples taken during the field investigation and two field tests using the Hvorslev method to determine in-situ hydraulic conductivity . The results of hydraulic conductivity testing are summarized in the following table:

TABLE 2
IN-SITU HYDRAULIC CONDUCTIVITY

Borehole	Sample No.	Sample Depth (m)	Elevation (m)	Hydraulic Conductivity (m/sec)	Soil Type	Comments
1	1U1	6.0 - 6.5	572.9	3.5×10^{-11}	Clay Till	Lab Test
3	NA	NA	NA	3.73×10^{-9}	Clay Till	Field Test
4	NA	NA	NA	1.27×10^{-9}	Clay Till	Field Test

From the in-situ testing, the range of hydraulic conductivity of the clay till subgrade soils were considered to be low permeable. In-situ k values are directly comparable to liner clay potential since they are derived from testing on undisturbed soils. The hydraulic conductivity of a small discrete lab sample taken from Borehole 1 is lower by an order of magnitude of 2. This difference is accounted for by the influence of soil structure features such as fractures and fissures in the clay till subgrade which would be more prominent in the field tests.

4.3.4 Groundwater Flow Velocity

Based on the readings from the groundwater monitoring wells, perched water conditions were present at this site and therefore groundwater flow velocity was not able to be accurately determined. Based on the lack of measureable groundwater and the very low permeability of the subgrade soils, vertical and horizontal movement of groundwater at this site is expected to be very slow and restricted.

5.0 DISCUSSION AND RECOMMENDATIONS

5.1 GEOTECHNICAL EVALUATION

The hydrogeological setting for this site is a thin layer of low permeable clay overlying extensive deposits of low permeable clay till. The static groundwater table was not able to be determined due to perched groundwater conditions and very low permeable soil which led to variable groundwater elevations across the site. The highest water elevation was observed in Borehole 3 at an elevation of 571.65 m, so the development of cells with floor elevations of 574.9 or higher will not be affected by groundwater. The near surface lacustrine clay soils have a high proportion of clay and in-situ hydraulic conductivity testing indicates that the clay and clay till soils comprise a soil strata which is suitable as a natural liner. Water retained in the proposed sewage lagoons will either evaporate, infiltrate into the groundwater table or run-off via man-made outlets into the natural local surface water drainage system for the area.

Overall acceptance of lagoon subgrade is typically dependent on having a native subgrade or a compacted liner of select clay material with a required hydraulic conductivity from tests on *in-situ* field samples. The hydraulic conductivity values specified for lagoon liner in Alberta Environment "Design and Construction of Liners for Municipal Wastewater Stabilization Ponds" are 2.0 to 4.0 x 10^{-9} m/s or lower. Field and laboratory hydraulic conductivity testing on the native subgrade soils show that they meet or exceed permeability specifications and therefore are considered suitable as liner soils. Based on the distance to possible receptors (ie. creeks, aquifers) and the significant potential for natural attenuation of seepage water infiltration in close proximity to the lagoon basin, the potential for significant negative environmental impacts from the proposed lagoon is considered to be low.

5.3 LAGOON CONSTRUCTION

5.3.1 Berm Configuration

Locally available medium plastic clay till material is expected to be used for berm construction. If it is to be used, high plastic clay should be mixed with the clay till to lower the plasticity. A slope angle of 3H:1V or flatter is recommended for the outside face of the proposed clay berms. The interior slopes should be constructed at slope angles of 5H:1V or flatter. Steeper interior slopes may be proposed provided the Owner is willing to accept the risk of possible localized instabilities. Recommendations for steeper side-slopes may be possible for constructed slope faces upon review of actual soil conditions and proposed face armouring. The pond shore line should be protected against erosion from wave action, because shoreline erosion may destabilize the pond slopes. Sideslopes should be vegetated as soon as possible after construction. The outsides slopes should also be well vegetated to protect against slumping and erosion.

Slope stability is influenced by precipitation, surface erosion, groundwater and soil moisture conditions. The main trigger for slope movement is expected to be erosion, wave action and slumping due to surficial wetting and weathering of the berms. Re-vegetation of the exposed berms

immediately after construction is highly recommended to protect the slope face from weathering. The exterior berm slope will be most prone to failure during periods of snow-melt and heavy or prolonged periods of precipitation. The interior slope faces will be most prone to failure during periods of pond draw-down. After construction the berm slopes should be monitored by maintenance personnel on a periodic basis. Any significant new slumping or tension crack development along the crests or slope faces should be reviewed by a qualified geotechnical engineer to review the potential impacts on the berm integrity.

5.3.2 Site Preparation

The development area should be stripped of all topsoil and weak or unsuitable foundation soils. Topsoil should be stockpiled for future use at the site. The pond should be cut to design configuration and any structural features such as fissuring or sand lenses which might promote seepage below the berms or base should be subcut and replaced with select clay fill materials.

5.3.3 Recommended Fill & Placement

Fill used for general berm construction of this lagoon should consist of select medium plastic clay fill. High plastic clay can be mixed into the medium plastic clay till. Engineered fill within the inside half of the proposed berms and the base or liner should be placed and compacted to at least 97 percent of SPMDD at a moisture content between 0 and 3 precent above OMC. The engineered fill placed from the centerline to the outside toe of the berm should be compacted to at least 95 percent of SPMDD at a moisture content on the wet side of OMC. Uniformity of compaction is most important. The lift thicknesses should be governed by the ability of the selected compaction equipment to uniformly achieve the recommended density. It is recommended that a maximum lift thickness of 200 mm for clay fill be utilized. Clay is best compacted with large vibratory "padfoot" or "sheepsfoot" rollers. Proper moisture conditioning will help remould the clay and reduce compactive effort needed to achieve maximum density (ie. minimizing the potential risk of subgrade disturbance).

5.3.4 Liner/Base Design

As stated in Section 5.1, the native clay and clay till material exhibited suitable clay characteristics for proposed liner soils, in terms of both the clay content and permeability. No liner construction is required at this site. After excavation of the lagoon basin, it is recommended to scarify, moisture condition and recompact the upper 150mm of clay to provide a natural clay liner for this site. It is important to minimize possible surface dessication due to drying prior to use. The lagoon base should be compacted to at least 95 percent of SPMDD at a moisture content at least 2 percent above OMC.

5.3.5 Miscellaneous Recommendations

Groundwater monitoring standpipes from the site investigation are presently located within the proposed lagoon cells. These wells should be properly decommissioned prior to construction. It is recommended to drill out these wells and backfill with non-shrink bentonite grout. Prior to decommissioning, it is suggested to obtain groundwater samples for water chemistry testing as a means of establishing pre-development water quality conditions for the new cell areas; and/or determining possible impacts of the existing lagoon on local groundwater quality in this area.

5.4 BURIED SERVICE INSTALLATION

5.4.1 Service Trench Excavation

It is expected that buried services for the sewage transmission line will be installed to depths up to about 4 m below finished grade with a typical depth of about 2.7 m. Excavations should be carried out in accordance with the most current Alberta Occupational Health and Safely Regulations. It is expected that most trenches will be excavated and based in stiff clay till. Conventional trenched excavations are considered to be feasible to protect workers in the trench. The side slope of conventional unsupported trench excavations would be dependent on the local soil conditions. In general, for excavations deeper than 1.5 m, it is recommended side slopes be cut back to a minimum angle of 1H:1V.

The degree of stability of excavated trench walls directly decreases with time and, therefore, construction should be directed at minimizing the length of time service trenches are left open. Groundwater seepage from the sides of the trenches and from the base of the excavation is not expected, except in seasonal conditions where perched water is encountered in the clay till after precipitation or snow melt.

Surface grading should be undertaken so that surface water is not allowed to pond adjacent to service trenches. Surcharge loads, including excavation spoil, should be kept back from the crest of the excavation a minimum distance equal to the excavation depth. Monitoring and maintenance of the slopes should be carried out on a regular basis.

Installation of underground services and utilities requires an observational approach be adopted which should combine past local experience, contractor's experience and geotechnical input. It would be desirable for the selected excavation contractor to be experienced in similar conditions and/or, alternatively, to excavate test pits in advance of construction to familiarize field personnel with subsurface conditions. Quality workmanship is essential.

5.4.2 Pipe Bedding

Minor deflections of the trench bedding are expected. Underground utility pipes should be of a type which will maintain watertight joints (i.e. rubber gasket) after minor shifting has occurred. Bedding requirements are a function of the class of pipe and trench configuration, as well as site specific geotechnical considerations. In general, granular pipe bedding should be relatively well graded sand or sand gravel mixture which can be readily compacted around the pipe to achieve a high frictional strength. Bedding soils must have an appropriate gradation so that migration of natural soils into the granular system is minimized. Uniform or gap-graded sands and gravels should not be used as bedding materials unless adequate provision is made to surround such soils with a filter fabric or graded granular filter compatible with the existing subsoils. In the unlikely event of significant groundwater seepage or wet base conditions, additional measures will be required.

5.4.3 Trench Backfill

Soil used for trench backfill should be free of frozen material, organics, and any other undesirable debris. It is expected that native clay till soils will be used at the site. The native clays are considered to be suitable for use as trench backfill. To minimize fill settlement under self-weight, it is not recommended to allow the use of excavated soil for fill where the water content exceeds the OMC of the soil by more than 5 percent. If excavated soils are excessively wet, the material should be dried or blended prior to use.

The clay backfill should be placed in thin lifts with a nominal thickness of 150 mm. The backfill should be uniformly compacted to a minimum of 95 percent of the SPMDD to within 1.5 m of the finished ground surface. For road crossings, the backfill should be compacted throughout the depth of the fill to a minimum 97 percent of SPMDD.

Some settlement of the compacted backfill in trenches under self-weight is expected to occur. The magnitude and rate of settlement would be dependent on the backfill soil type, the moisture condition of the backfill at the time of placement, the depth of the service trench, drainage conditions and the initial density achieved during compaction. For trenching compacted to 95 percent of the SPMDD, settlement in the order of 3 to 4 percent of the fill depth could be expected. Mounding these trenches 50 to 100 mm would minimize the effects of this settlement. Other options include returning to the site after one year and regrading. Density monitoring of backfill placement is recommended to encourage better attention to quality workmanship in placement. Fill materials with variable moisture contents recompacted as trench backfill will not provide uniform roadway subgrades for the support of pavement sections.

5.5 INSPECTION

It is recommended that on-site inspection and testing be performed to verify that actual site conditions are consistent with assumed conditions which meet or exceed design criteria.

6.0 LIMITATIONS AND CLOSURE

Geological conditions are variable. At the time this report was prepared, information on the sub-surface conditions was available only at the borehole locations. Therefore, it was necessary to make certain assumptions concerning conditions between the borehole locations.

The recommendations presented in this report, and any subsequent correspondence, are based on an evaluation of information derived from five boreholes and from other sources of information mentioned in this report. The conditions found are thought to be reasonably representative of the site. If conditions are noted during construction which are believed to be at variance with the conditions described in this report, this office should be contacted immediately.

This report has been prepared for the exclusive use of **The Homeland Hutterite Colony,** and their approved agents for specific application to the project and site described in this report. Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. It has been prepared in accordance with generally accepted geotechnical engineering practices. No other warranty is made either express or implied. Parkland Geo-Environmental Ltd. and The ParklandGEO Consulting Group accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report.

The recommendations in this report should not be used for any other development on this site nor for any other site. Any persons attempting to apply these recommendations to any other project or any other site, do so at their peril.

We trust that this report meets with your current requirements. If there are any questions, please contact the undersigned at 780-539-5102.
Respectfully Submitted,
PARKLAND GEOTECHNICAL LTD.
APEGGA Permit to Practice No. P09516

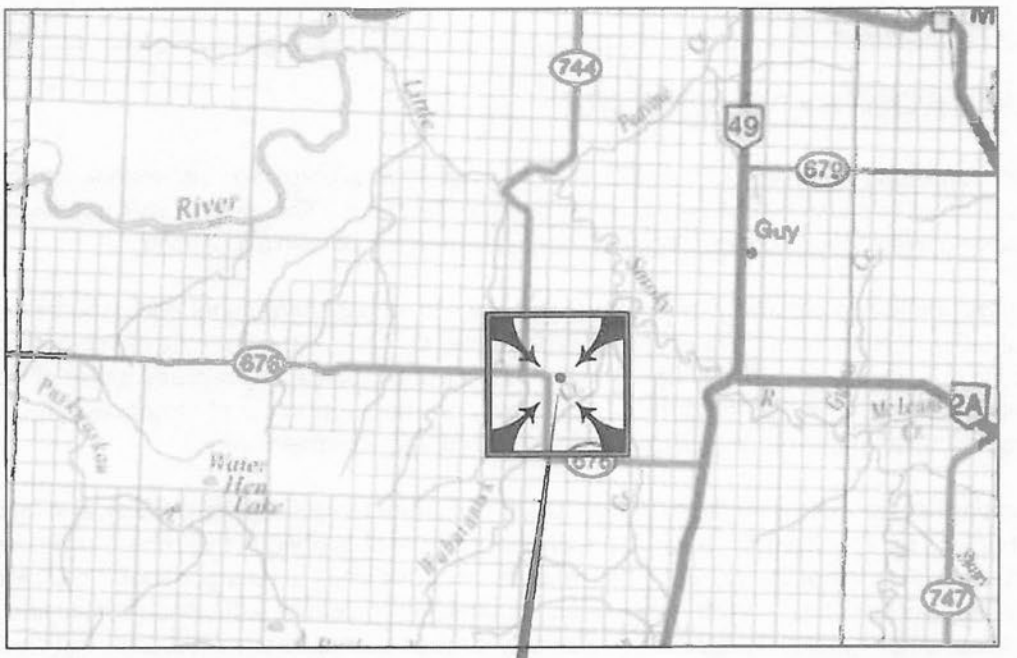
Neal Maloney

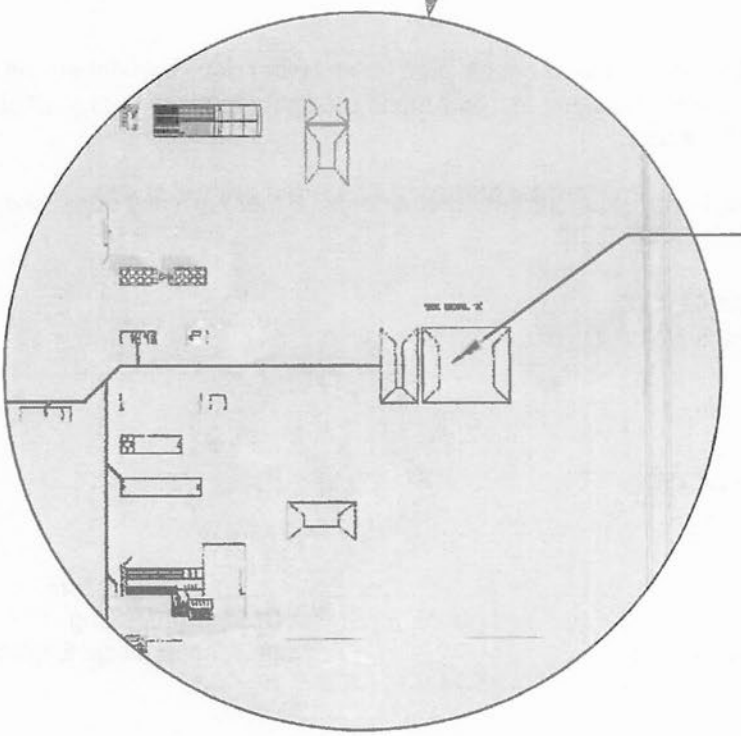
PROFESSIONAL ENGINEER
Mark D. Brotherton
PROVINCE OF ALBERTA

Jan 12, 2011

Neal Maloney, C.Tech.,
Geotechnical Technologist

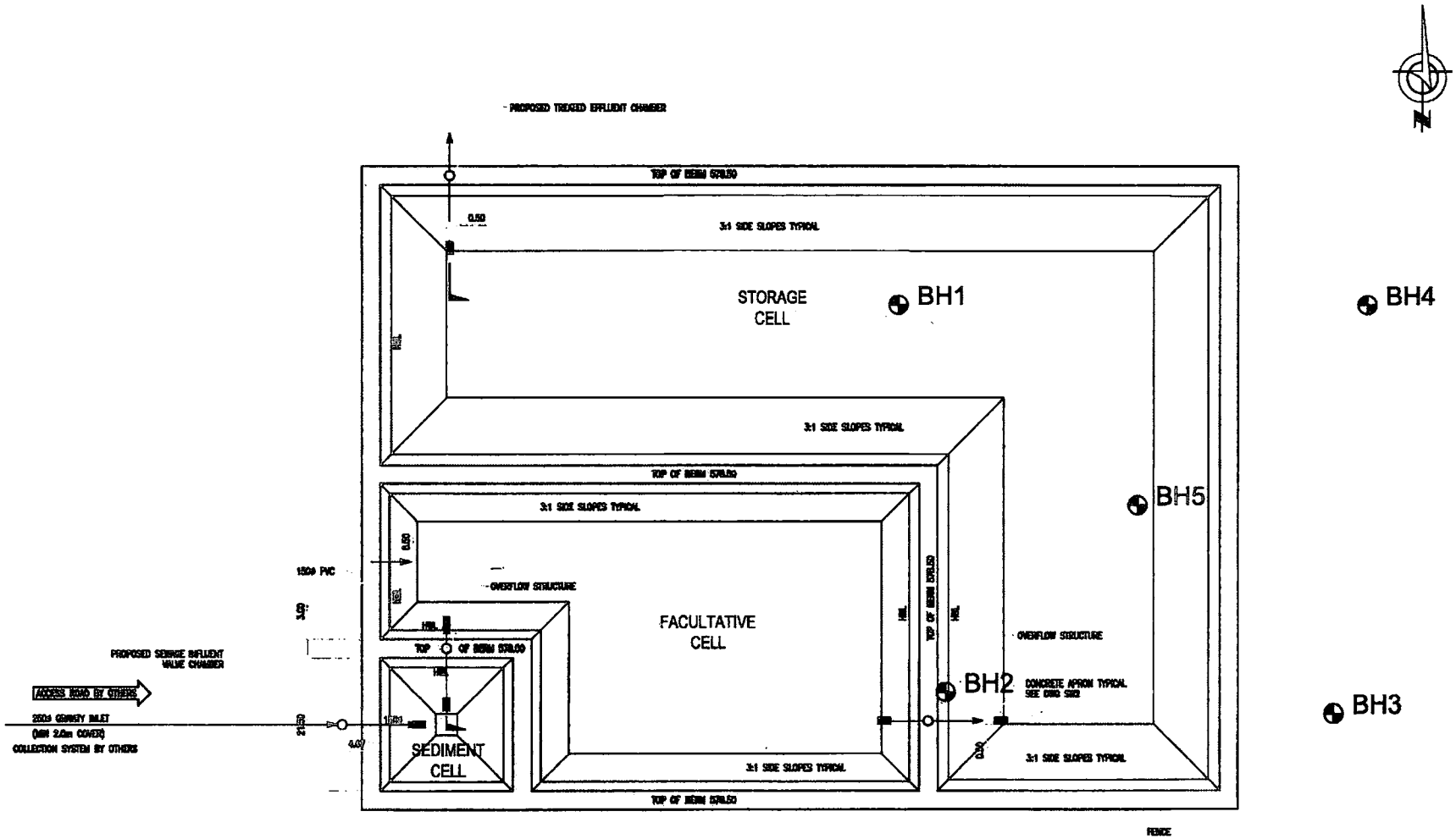
Mark Brotherton, P.Eng.
Principal Geotechnical Engineer





SITE LOCATION

Parkland GEO	CLIENT: HOMELAND HUTTERITE COLONY	AREA PLAN		
		GEOTECHNICAL INVESTIGATION NE 32-74-22 W5M, MD OF SMOKY RIVER, ALBERTA		
		DRAWN: IM	CHK'D.: MDB	REV #: 0	DATE: NOVEMBER,2010.
		SCALE: NTS	JOB NO. GP1758		DRAWING NO. FIGURE 1



NOTE:
1. ORIGINAL SURVEY PROVIDED BY FOCUS CORPORATION.

Parkland GEO	CLIENT: HOMELAND HUTTERITE COLONY	SITE PLAN GEOTECHNICAL INVESTIGATION NE 32-74-22 W5M, MD OF SMOKY RIVER, ALBERTA

DRAWN:	CHK'D.:	REV #:	DATE:
IM	MDB	0	NOVEMBER, 2010.
SCALE: NTS	JOB NO. GP1758		DRAWING NO. FIGURE 2

APPENDIX A

PARKLANDGEO BOREHOLE LOGS

EXPLANATION SHEETS

ParklandGEO

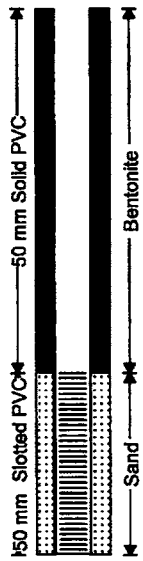
BOREHOLE NO.: BH1

CLIENT: Homeland Hutterian Colony
SITE: 32-74-22 W5M
NOTES: Proposed Sewage Lagoon

PROJECT NO.: GP1758
BH LOCATION:

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |---X---| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE								0.00
1	***Clay*** -little sand, little silt, stiff, medium to high plastic, slickensides, moist.				1G1				-1.50
2	***Clay Till*** -some sand, some silt, trace fine to coarse gravel sizes, very stiff, medium plastic, sand pockets, silt seams, rust inclusions, salt deposits, moist.				1G2				
3					1G3				
4									
5									
6					1G4		SAND: 22.5% SILT: 35.0% CLAY: 42.5%		
					1U1				
7					1G5				
					1G6				
8					1G7				
9					1G8		SAND: 23.5% SILT: 34.0% CLAY: 42.5%		-9.00
9	END OF BOREHOLE								
10	Borehole dry on Completion								
11	Borehole dry on July 28-2010								
	Borehole dry on Aug 6-2010								
12	Borehole dry on Sept 22-2010								
13									
14									
15									
16									
17									
18									
19									
20									



LOGGED BY: IM
CONTRACTOR: Frontier Enviro-Drilling Ltd.
RIG/METHOD: TSS
DATE: 15-July-10

GROUND ELEVATION: 578.9
NORTHING:
EASTING:

ParklandGEO

CLIENT: Homeland Hutterian Colony
SITE: 32-74-22 W5M
NOTES: Proposed Sewage Lagoon

BOREHOLE NO.: BH2

PROJECT NO.: GP1758
BH LOCATION:

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |—X—| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE								0.00
1	***Clay*** -little sand, little silt, stiff, medium to high plastic, slickensides, moist.				2G1				
2	***Clay Till*** -some sand, some silt, trace fine to coarse gravel sizes, very stiff, medium plastic, sand pockets, silt seams, rust inclusions, salt deposits, coal deposits, moist.				2G2				-1.50
3					2G3				
4									
5					2G4				
6									
7					2G5				
8									
9					2G6		GRAVEL: 0.5% SAND: 27.0% SILT: 32.0% CLAY: 40.0%		
10					2U1				
11	END OF BOREHOLE				2G7				-11.00
12	Borehole dry upon completion				2G8				
13	Borehole dry on July 28-2010								
14	Borehole dry on Aug 6-2010								
15	Borehole dry on Sept 22-2010								
16									
17									
18									
19									
20									

LOGGED BY: IM
CONTRACTOR: Frontier Enviro-Drilling Ltd.
RIG/METHOD: TSS
DATE: 15-July-10

GROUND ELEVATION: 578.81
NORTHING:
EASTING:

Parkland GEO

BOREHOLE NO.: BH3

CLIENT: Homeland Hutterian Colony
SITE: 32-74-22 W5M
NOTES: Proposed Sewage Lagoon

PROJECT NO.: GP1758
BH LOCATION:

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |—X—| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
	GROUND SURFACE								0.00
0–1	***Clay*** -little sand, little silt, stiff, medium to high plastic, slickensides, moist.				3G1				-1.50
1–8	***Clay Till*** -some sand, some silt, trace fine to coarse gravel sizes, very stiff, medium plastic, sand pockets, silt seams, rust inclusions, salt deposits, coal deposits, moist.				3G2 3B1 3G3 3G4 3G5 3G6 3U1		GRAVEL: 0.50% SAND: 25.5% SILT: 33.0% CLAY: 41.0% SAND: 25.00% SILT: 32.5% CLAY: 42.5%	50 mm Solid PVC 50 mm Slotted PVC Bentonite Sand Water level on Sept 22-10	-8.00
8	END OF BOREHOLE								
9	Borehole dry upon completion								
10	Water level at 6.77 m on July 28-2010								
11	Water level at 6.8 m on Aug 6-2010								
12	Water level at 6.92 m on Sept 22-2010								
13–20									

LOGGED BY: IM
CONTRACTOR: Frontier Enviro-Drilling Ltd.
RIG/METHOD: TSS
DATE: 15-July-10

GROUND ELEVATION: 578.42
NORTHING:
EASTING:

Parkland GEO

BOREHOLE NO.: BH4

CLIENT: Homeland Hutterian Colony
SITE: 32-74-22 W5M
NOTES: Proposed Sewage Lagoon

PROJECT NO.: GP1758
BH LOCATION:

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp |----X----| Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE								0.00
1	***Clay*** -little sand, little silt, stiff, medium to high plastic, slickensides, moist.				4G1				
					4G2				-1.50
2	***Clay Till*** -some sand, some silt, trace fine to coarse gravel sizes, very stiff, low to medium plastic, sand pockets, silt seams, rust inclusions, salt deposits, coal deposits, moist.								
3					4G3		SAND: 25.5% SILT: 30.0% CLAY: 44.5%		
4					4G4				
5					4U1				
6					4G5				
7					4G6				
8									
9					4G7				
10					4G8				
					4G9				-10.50
11	END OF BOREHOLE								
12	Borehole dry upon completion Water level at 9.73 m on July 28-2010								
13	Water level at 9.47 m on Aug 6-2010 Water level at 10.28 m on Sept 22-2010								
14									
15									
16									
17									
18									
19									
20									

Well Completion Details: 50 mm Solid PVC; 50 mm Slotted PVC; Bentonite; Sand; Water level on Sept 22-10

LOGGED BY: IM
CONTRACTOR: Frontier Enviro-Drilling Ltd.
RIG/METHOD: TSS
DATE: 15-July-10

GROUND ELEVATION: 578.33
NORTHING:
EASTING:

ParklandGEO

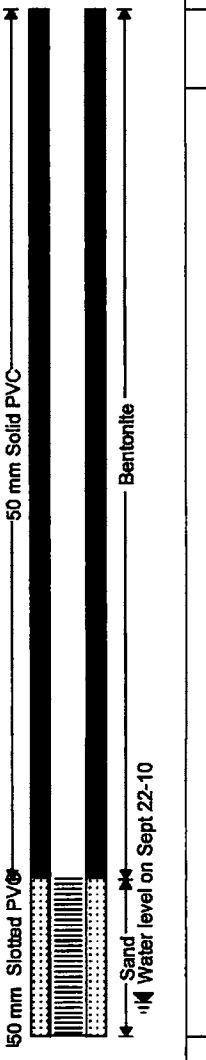
BOREHOLE NO.: BH5

CLIENT: Homeland Hutterian Colony
SITE: 32-74-22 W5M
NOTES: Proposed Sewage Lagoon

PROJECT NO.: GP1758
BH LOCATION:

SUBSURFACE PROFILE

Depth (m)	Description	Symbol	Moisture (Wp ⊢X⊣ Wl) 25 50 75	Type	Sample No	SPT (N)	Comments	Well Completion Details	Elevation (m)
0	GROUND SURFACE								0.00
1	***Clay*** -little sand, little silt, stiff, medium to high plastic, slickensides, moist.				5G1				
					5B1				-1.50
2	***Clay Till*** -some sand, some silt, trace fine to coarse gravel sizes, very stiff, medium plastic, sand pockets, silt seams, rust inclusions, salt deposits, coal deposits, moist.				5G2				
3					5B2		GRAVEL: 0.00% SAND: 21.95% SILT: 34.68% CLAY: 43.37%		
4					5G3				
5					5G4				
6					5G5				
7					5U1				
8					5U2				
9					5G6				
10					5G7				
11					5G8		GRAVEL: 0.49% SAND: 23.50% SILT: 34.30% CLAY: 41.71%		
12									
13					5G9				
14					5G10				
15									
16					5G11				
17									
18					5G12				
19	-grey color				5G13				-19.50
20	END OF BOREHOLE								
21	Borehole dry upon completion Borehole dry on July 28-2010								
22	Water level at 19.3 m on Aug 6-2010 Water level at 18.84 m on Sept 22-2010								
23									



LOGGED BY: IM
CONTRACTOR: Frontier Enviro-Drilling Ltd.
RIG/METHOD: TSS
DATE: 15-July-10

GROUND ELEVATION: 578.33
NORTHING:
EASTING:

GEOTECHNICAL INVESTIGATION
EXPLANATION OF TERMS AND SYMBOLS

The terms and symbols used on the borehole logs to summarize the results of field investigation and subsequent laboratory testing are described in these parts.

It should be noted that materials, boundaries and conditions have been established only at the borehole locations at the time of investigation and are not necessarily representative of subsurface conditions elsewhere across the site.

SOIL CLASSIFICATION AND DESCRIPTION

Soils are classified and described according to their engineering properties and behaviour.

The soil of each stratum is described using the United Soil Classification System[1] modified slightly so that an inorganic clay of "medium plasticity" is recognized.

The use of modifying adjectives may be employed to define the actual or estimated percentage range by weight of minor components. This is similar to a system developed by D.M. Burmister.[2] The soil classification system is shown in greater detail on page 2.

Cohesionless Soils		Cohesive Soils	
Relative Density	SPT (N) Value	Consistency	Unconfined Strength (kPa)
Very Loose	0 - 4	Very Soft	0 - 10
Loose	4 - 10	Soft	10 - 25
Compact	10 - 30	Firm	25 - 50
Dense	30 - 50	Stiff	50 - 100
Very Dense	>50	Very Stiff	100 - 200
		Hard	>200

Standard Penetration Resistance ("N" value)

The number of blows by a 63.6 kg hammer dropped 760 mm to drive a 50 mm diameter open sampler attached to "A" size drill rods for a distance of 300 mm.

TEST DATA

Data obtained during the field investigation and from laboratory testing are shown at the appropriate depth interval.

Abbreviations, graphic symbols, and relevant test method designations are as follows:

*C	Consolidation Test	*ST	Swelling Test
D_R	Relative Density	TV	Torvane Shear Strength
Fines	Percentage by weight smaller than #200 sieve	VS	Vane shear strength (undistured-remolded)
k	Hydraulic Conductivity	w	Natural moisture content (ASTM D 2216)
*MA	Mechanical grain size analysis & hydormeter test	w_L	Liquid limit (ASTM D 423)
N	Standard penetration test (CSA A119.1-60)	w_p	Plastic limit (ASTM D 424)
N_d	Dynamic cone penetration test	ε_f	Unit strain at failure
NP	Non Plastic soil	γ	Unit weight of soil or rock
pp	Pocket penetrometer strength	γ_d	Dry unit weight of soil or rock
*q	Triaxial compression test	ρ	Density of soil or rock
q_u	Unconfined compressive strength	ρ_d	Dry Density of soil or rock
*SB	Shearbox test	ρ_w	Wet Density of soil or rock
SO_4	Concentration of water-soluble sulphate	▼	Observed water level
C_u	Undrained shear strength	→	Seepage

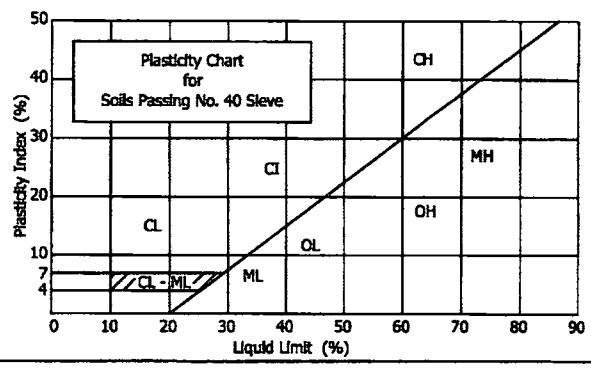
**The results of these tests usually are reported separately*

1. "Unified Soil Classification System", Technical Memorandum 3-357 prepared for Office, Chief of Engineering, by Waterways Experiment Station, Vicksburg, Mississippi, Corps of Engineers, U.S. Army. Vol 1, March 1953
2. American Society for Testing and Materials, Procedures for Testing Soils, "Suggested Methods of Testing for Identification of Soils", 4th Ed: pp 221-233, Dec. 1964

MODIFIED UNIFIED CLASSIFICATION SYSTEM FOR SOILS

SOIL COMPONENTS

FRACTION	US STANDARD SIEVE SIZE	DEFINING RANGES OF PERCENTAGE BY WEIGHT OF MINOR COMPONENTS	
	PASSING/RETAINED	PERCENT	DESCRIPTOR
GRAVEL coarse	76mm 19mm	50 - 35	and
fine	19mm No 4	35 - 20	some
SAND coarse	4.75mm 2.00mm	20 - 10	little
medium	2.00mm 425μm	10 - 1	trace
fine	425μm 75μm		
SILT (non-plastic) or CLAY (plastic)	75 μm		



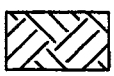
OVERSIZE MATERIAL

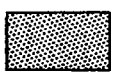
Rounded or Subrounded	Not Rounded
COBBLES 75mm to 200mm	ROCK FRAGMENTS 76mm
BOULDERS >200mm	ROCKS > 0.76 cubic metre in volume

1. All sieve sizes mentioned on this chart are US STANDARD, A.S.T.M.
2. Boundary classifications possessing characteristics of two groups are given combined group symbols. E.G. GW-GC is a well graded gravel/sand mixture with clay binder between 5% and 12%

MAJOR DIVISION			GROUP SYMBOL	GRAPH SYMBOL	TYPICAL DESCRIPTION	LABORATORY CLASSIFICATION CRITERIA	
COARSE-GRAINED SOILS (More than Half by Weight Larger than 200 Sieve)	GRAVELS More Than Half Coarse Grained Larger Than No. 4 Sieve	CLEAN GRAVELS (Little or No Fines)	GW		Well Graded Gravels, Little or No Fines	$C_u = \frac{D60}{D10} > 4$ $C_c = \frac{(D30)^2}{D10 \times D60} = 1$ to 3	
			GP		Poorly Graded Gravels, and Gravel/Sand Mixtures, Little or No Fines	Not Meeting Above Requirements	
		DIRTY GRAVELS (With Some Fines)	GM		Silty Gravels, Gravel/Sand/Silt Mixtures	Content of Fines Exceeds 12%	Atterberg Limits Below "A" Line or P.I. Less Than 4
			GC		Clayey Gravels, Gravel/Sand/Clay Mixtures		Atterberg Limits Above "A" Line P.I. More Than 7
	SANDS More Than Half Fine Grains Smaller Than No. 4 Sieve	CLEAN SANDS (Little or No Fines)	SW		Well Graded Sands, Gravelly Sands, Little or No Fines	$C_u = \frac{D60}{D10} > 4$ $C_c = \frac{(D30)^2}{D10 \times D60} = 1$ to 3	
			SP		Poorly Graded Sands, Little or No Fines	Not Meeting Above Requirements	
		DIRTY SANDS (With Some Fines)	SM		Silty Sands, Sand/Silt Mixtures	Content of Fines Exceeds 12%	Atterberg Limits Below "A" Line P.I. Less Than 4
			SC		Clayey Sands, Sand/Clay Mixtures		Atterberg Limits Above "A" Line P.I. More Than 7
FINE-GRAINED SOILS (More than Half by Weight Passes 200 Sieve)	SILTS Below "A" Line Negligible Organic Content	$W_L < 50\%$	ML		Inorganic Silts and Very Fine Sands, Rock Flour, Silty Sands of Slight Plasticity	Classification Is Based Upon Plasticity Chart (see above)	
		$W_L > 50\%$	MH		Inorganic Silts, Micaceous or Diatomaceous, Fine Sandy or Silty Soils		
	CLAY Above "A" Line on Plasticity Chart Negligible Organic Content	$W_L < 30\%$	CL		Inorganic Clays of Low Plasticity, Gravelly, Sandy, or Silty Clays. Lean Clays.		
		$30\% < W_L < 50\%$	CI		Inorganic Clays of Medium Plasticity. Silty Clays.		
		$W_L > 50\%$	CH		Inorganic Clays of High Plasticity. Fat Clays.		
	ORGANIC SILTS & CLAYS Below Line "A" Line on Chart	$W_L < 50\%$	OL		Organic Silts and Organic Silty Clays of Low Plasticity.	Whenever the Nature of the Fine Content Has Not Been Determined. SF is a Mixture of Sand with Silt or Clay.	
		$W_L > 50\%$	OH		Organic Clays of High Plasticity		
HIGHLY ORGANIC SOILS			Pt		Peat and Other Highly Organic Soils	Strong Color or Odor, and often Fibrous Texture	

SPECIAL SYMBOLS

BEDROCK 

VOLCANIC ASH 

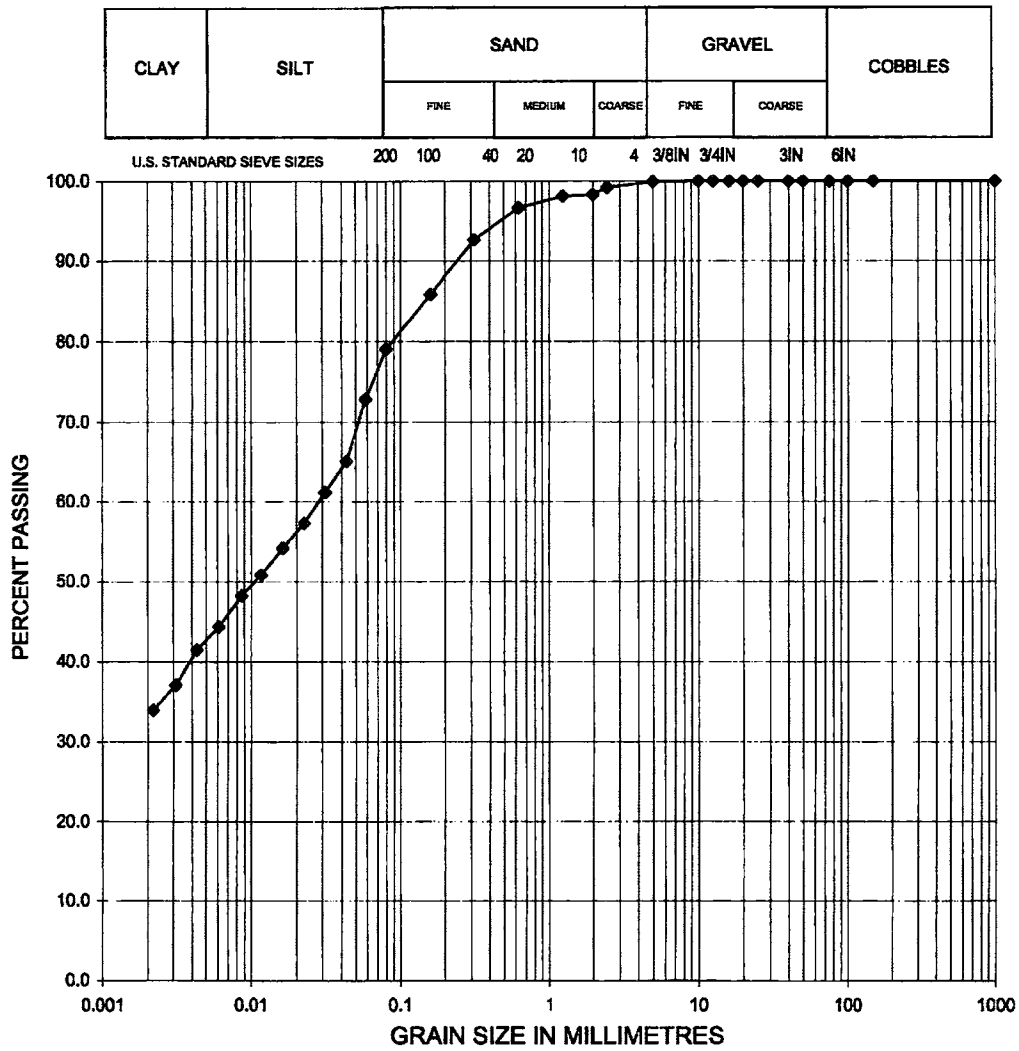
Parkland GEO

APPENDIX B

LABORATORY AND FIELD TEST RESULTS

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	1	**DATE**	22-Jul-10
DEPTH	5.5m	**TECH**	
SAMPLE #	1G4		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

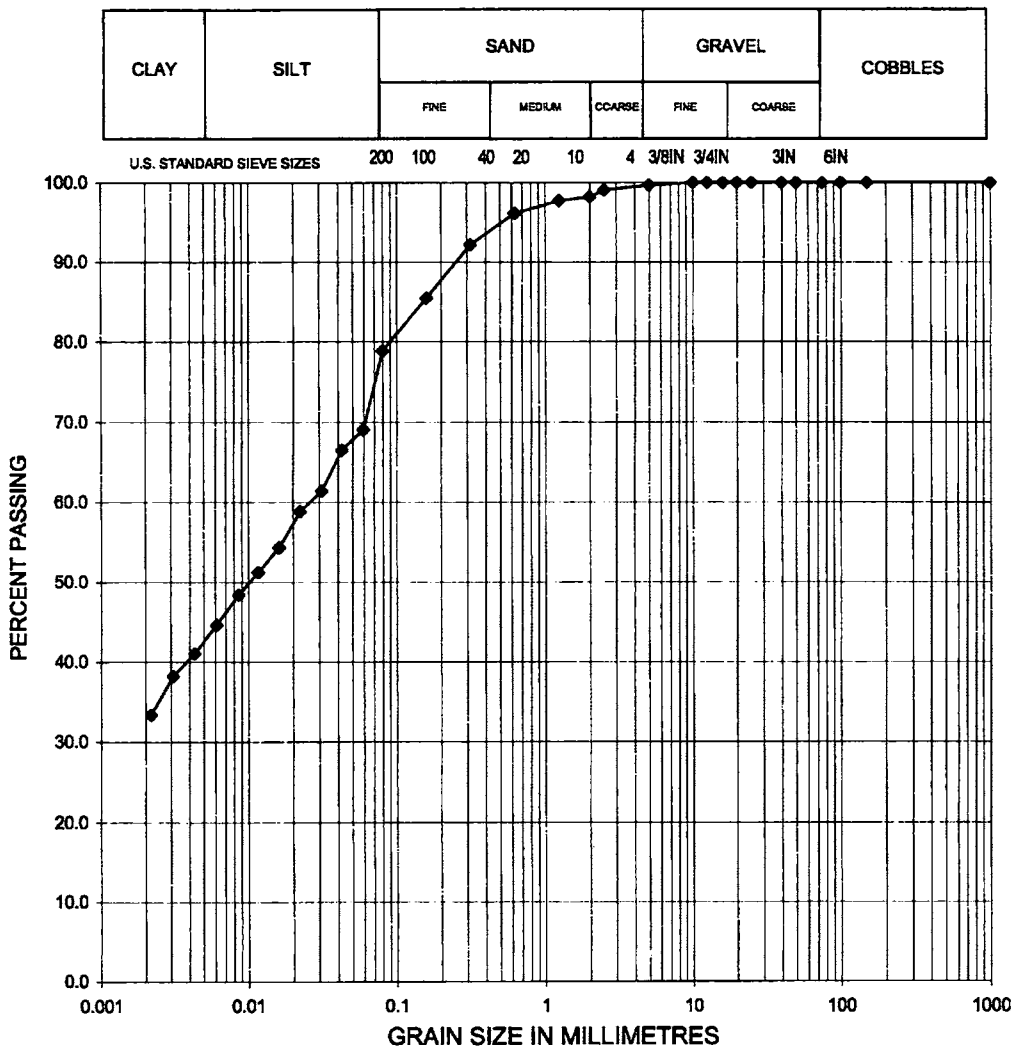
% Retained on 2 mm seive	1.71%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.09%
D30	=	SAND	22.37%
D60	=	SILT	35.02%
CU	=	CLAY	42.52%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	1	**DATE**	22-Jul-10
DEPTH	8.8m	**TECH**	
SAMPLE #	1G8		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

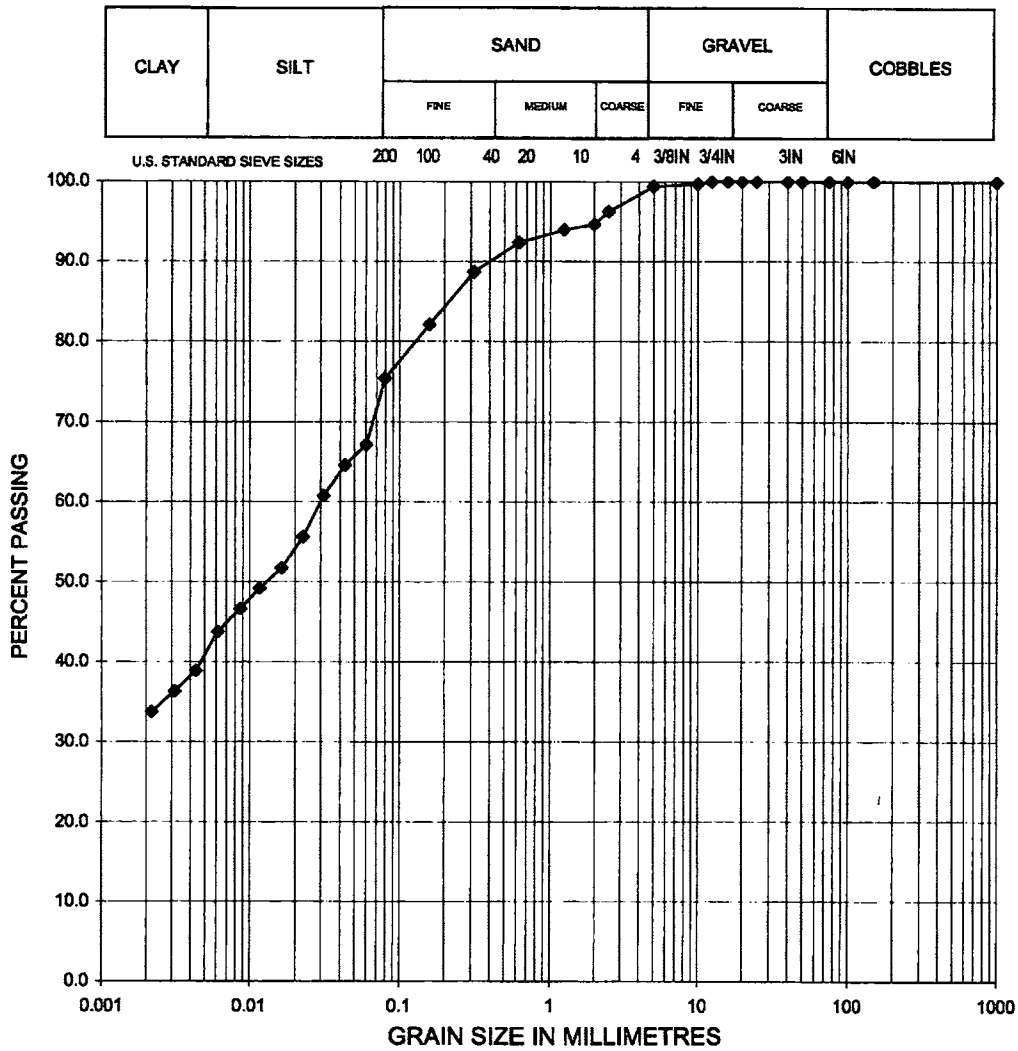
% Retained on 2 mm seive 1.81%
Soil Type Clay Till

SUMMARY

D10	=	GRAVEL	0.31%
D30	=	SAND	23.54%
D60	=	SILT	33.80%
CU	=	CLAY	42.35%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	2	**DATE**	22-Jul-10
DEPTH	8.5m	**TECH**	
SAMPLE #	2G6		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

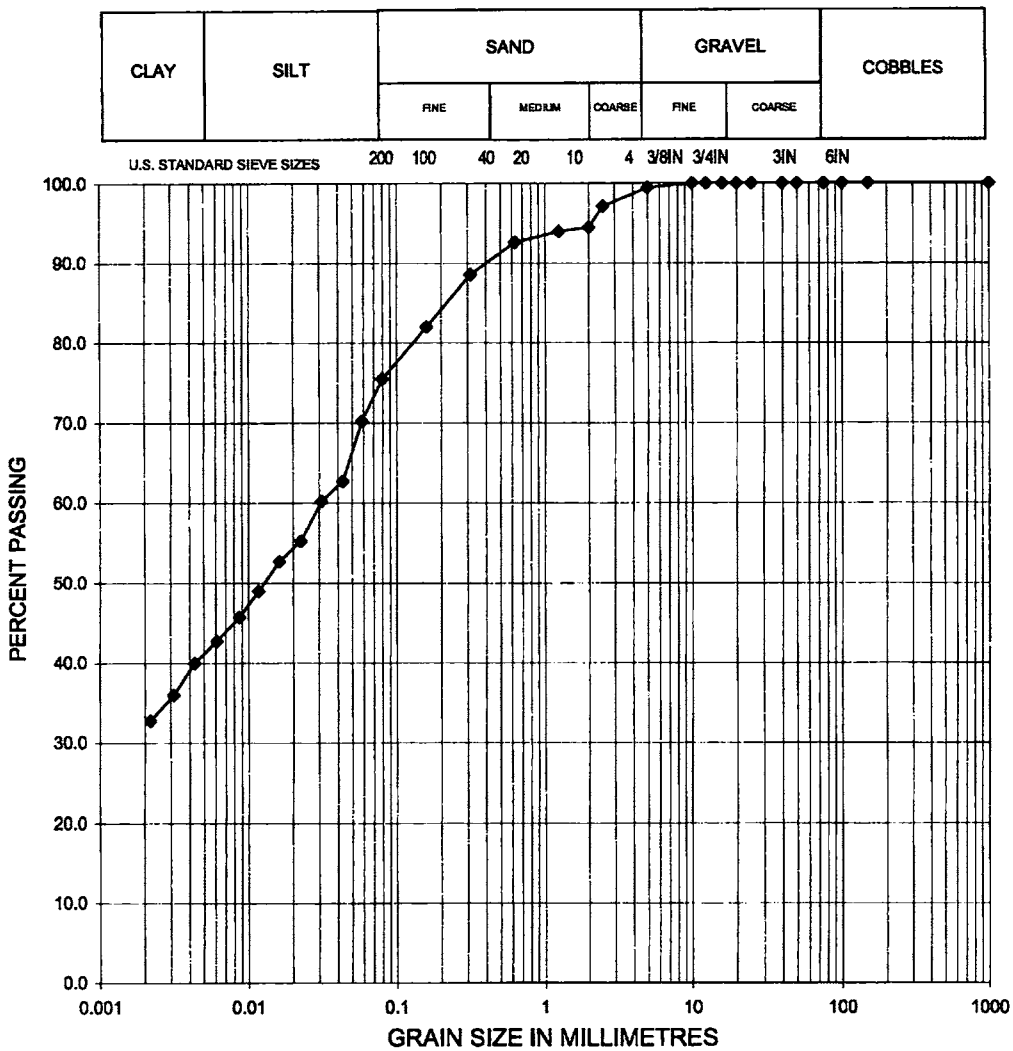
% Retained on 2 mm seive	5.40%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.58%
D30	=	SAND	26.71%
D60	=	SILT	32.15%
CU	=	CLAY	40.55%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	3	**DATE**	22-Jul-10
DEPTH	4.8m	**TECH**	
SAMPLE #	3G4		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

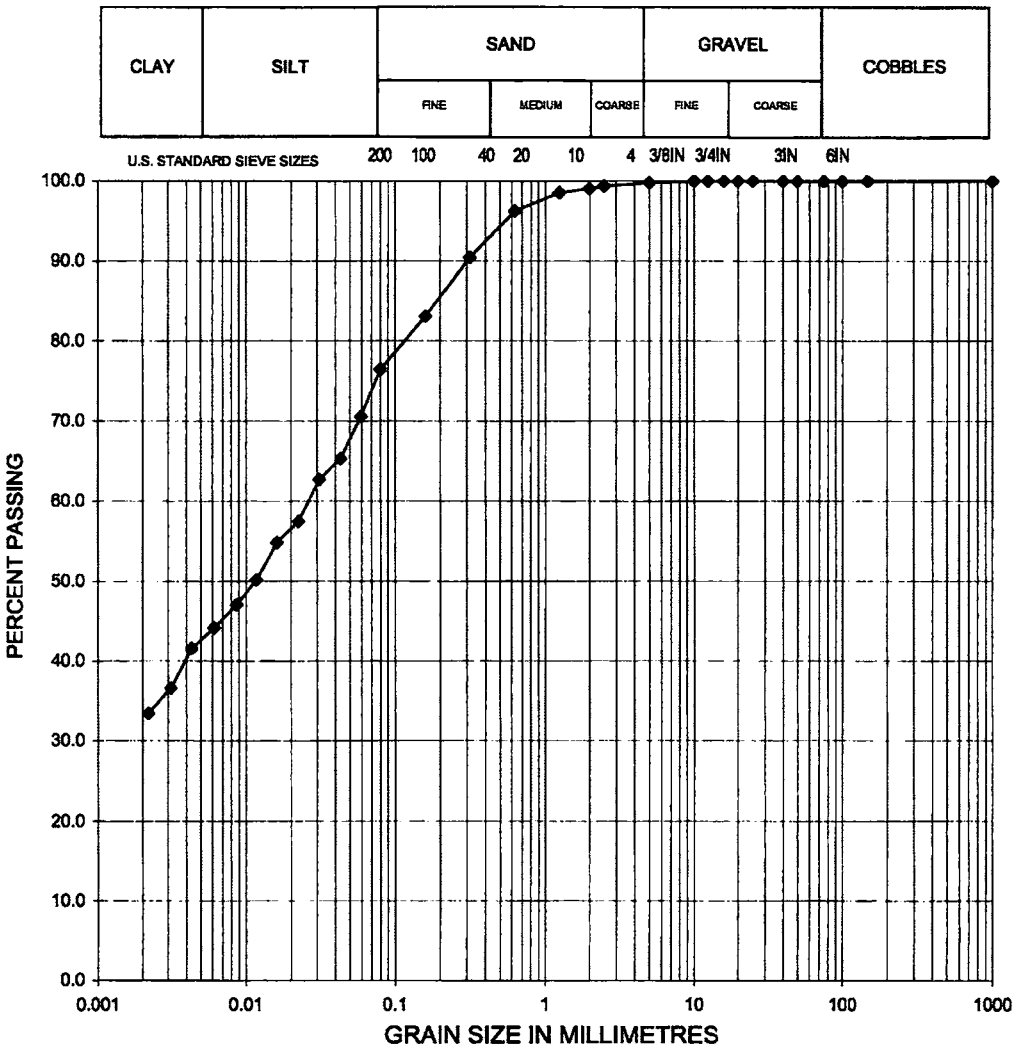
% Retained on 2 mm seive	5.52%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.56%
D30	=	SAND	25.73%
D60	=	SILT	32.73%
CU	=	CLAY	40.98%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	3	**DATE**	22-Jul-10
DEPTH	7.3m	**TECH**	
SAMPLE #	3G6		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

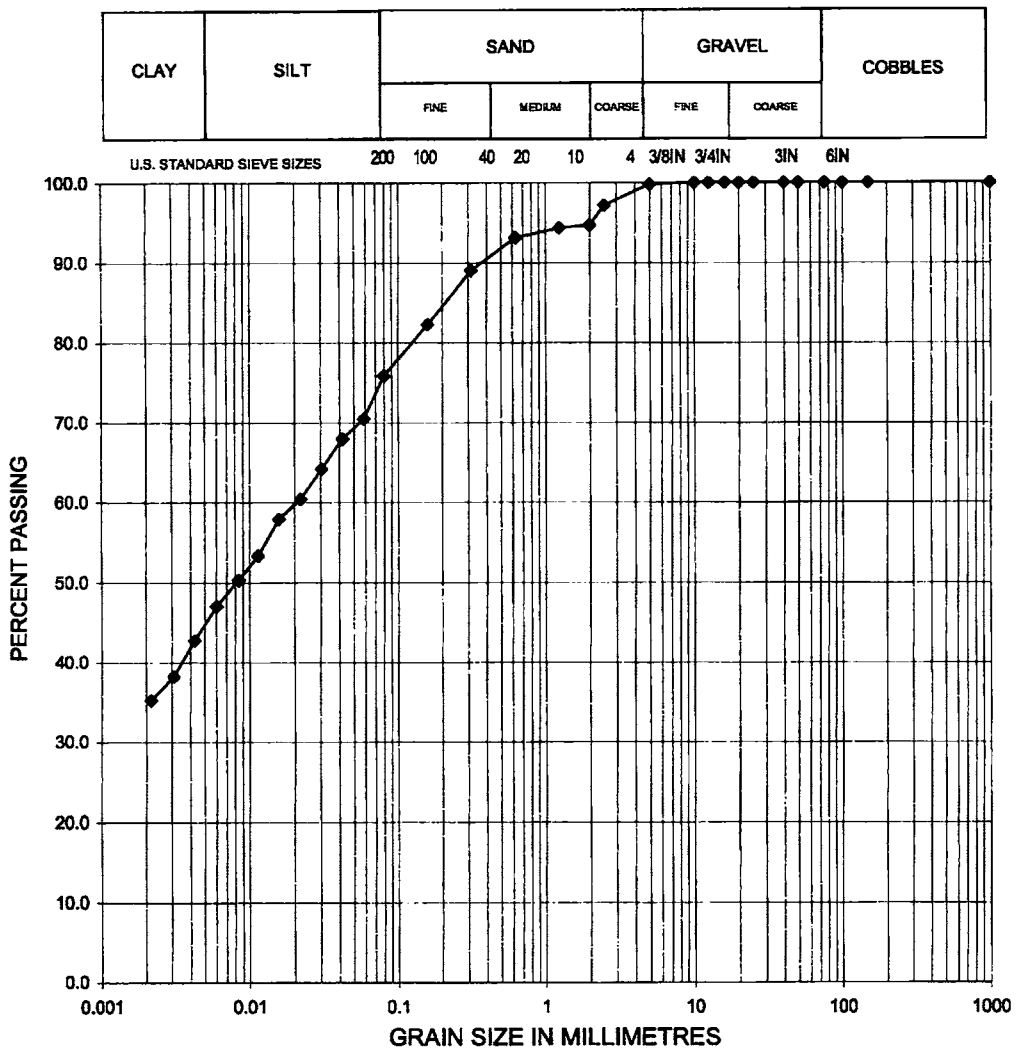
% Retained on 2 mm seive	0.95%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.20%
D30	=	SAND	25.00%
D60	=	SILT	32.33%
CU	=	CLAY	42.48%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	4	**DATE**	22-Jul-10
DEPTH	2.5m	**TECH**	
SAMPLE #	4G3		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

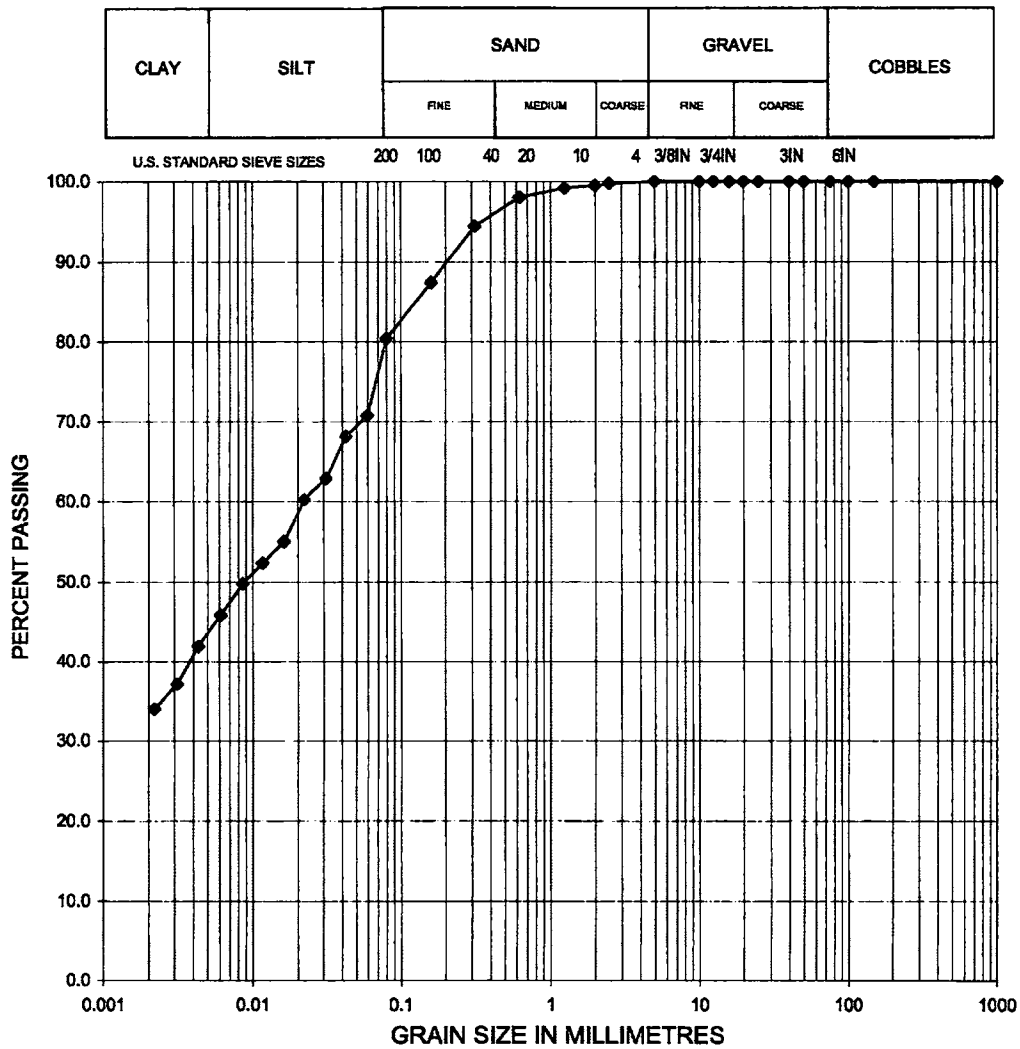
% Retained on 2 mm seive	5.31%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.21%
D30	=	SAND	25.38%
D60	=	SILT	29.87%
CU	=	CLAY	44.54%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	5	**DATE**	22-Jul-10
DEPTH	3.0m	**TECH**	
SAMPLE #	5G3		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

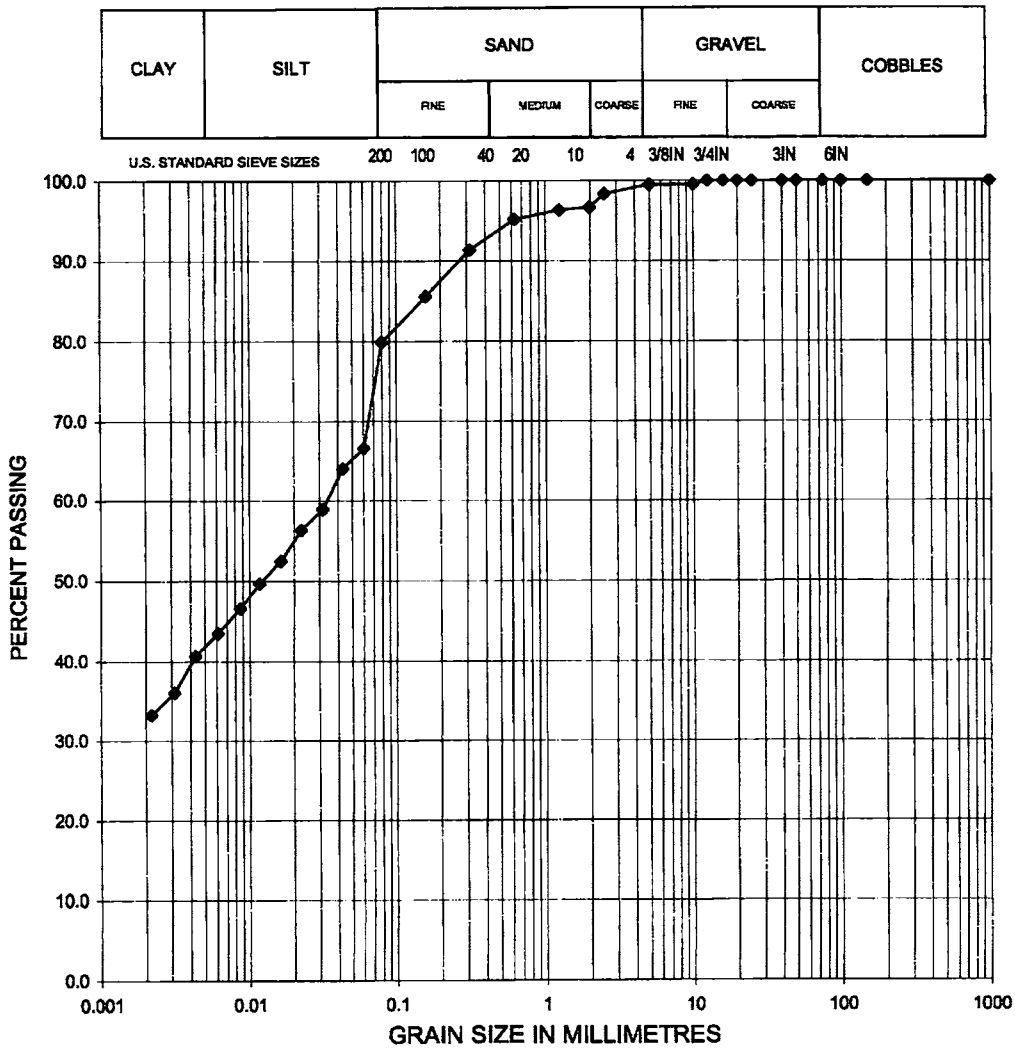
% Retained on 2 mm seive	0.49%
Soil Type	Clay Till

SUMMARY

D10	=	GRAVEL	0.00%
D30	=	SAND	21.95%
D60	=	SILT	34.68%
CU	=	CLAY	43.37%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	5	**DATE**	22-Jul-10
DEPTH	11.5m	**TECH**	
SAMPLE #	5G8		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

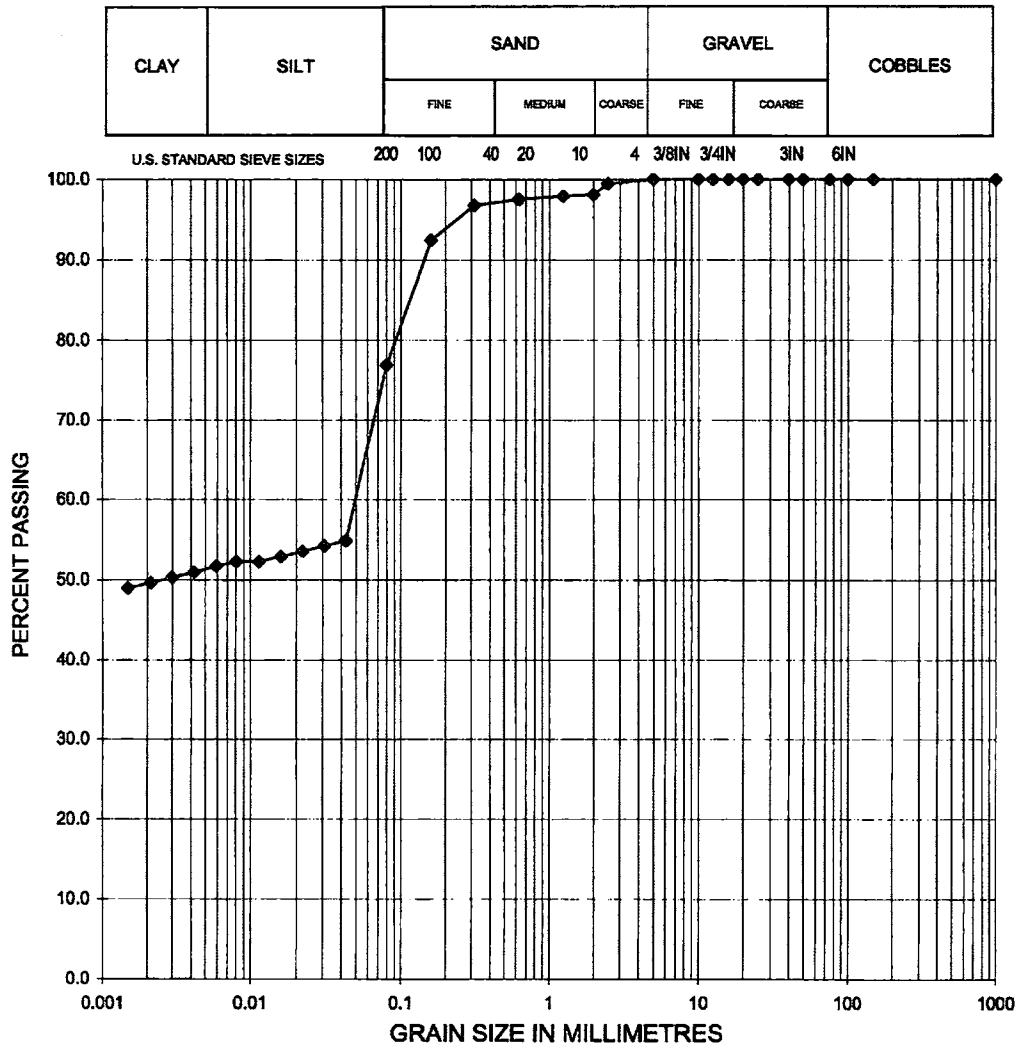
% Retained on 2 mm seive	3.36%
Soil Type	

SUMMARY

D10	=	GRAVEL	0.49%
D30	=	SAND	23.50%
D60	=	SILT	34.30%
CU	=	CLAY	41.71%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	1	**DATE**	22-Jul-10
DEPTH	1.0m	**TECH**	
SAMPLE #	1G1		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

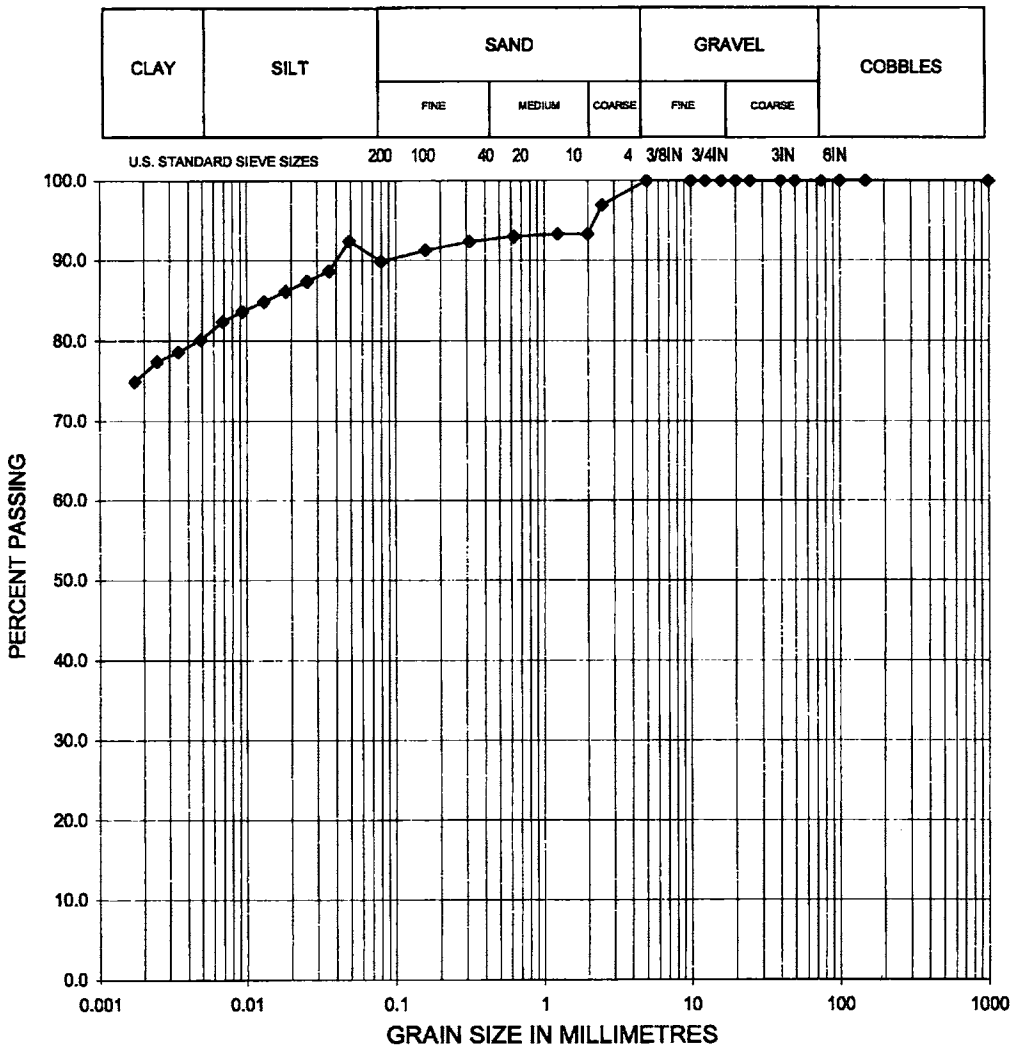
% Retained on 2 mm seive	1.92%
Soil Type	

SUMMARY

D10	=	GRAVEL	0.00%
D30	=	SAND	26.08%
D60	=	SILT	22.55%
CU	=	CLAY	51.37%
CC	=		

PROJECT	Homeland Hutterian Colony Sewage Lagoon		
PROJECT #	GP1758		
BOREHOLE #	3	**DATE**	22-Jul-10
DEPTH	0.9m	**TECH**	
SAMPLE #	3G1		
LOCATION			

GRAIN SIZE DISTRIBUTION



COMMENTS:

% Retained on 2 mm seive	6.74%
Soil Type	

SUMMARY

D10	=	GRAVEL	0.00%
D30	=	SAND	9.75%
D60	=	SILT	10.00%
CU	=	CLAY	80.25%
CC	=		

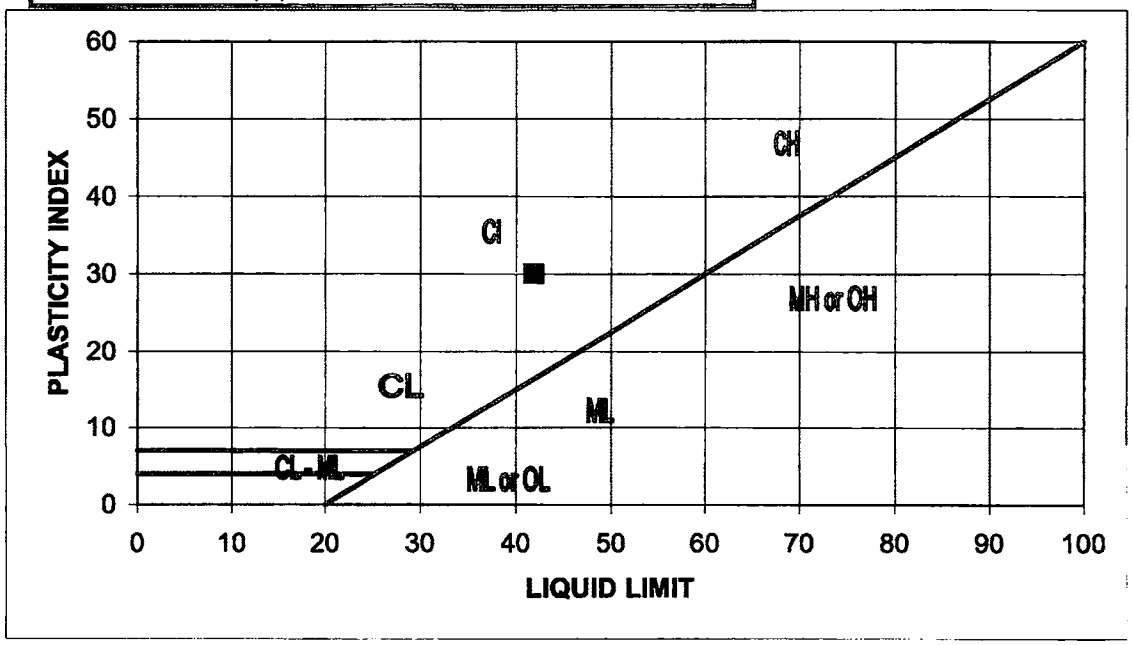
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 1
DEPTH 5.5m
SAMPLE # 1G4
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	21	22
Wt. Sample Wet + Tare	53.404	46.157
Wt. Sample Dry + Tare	46.353	41.097
Wt. Water	7.051	5.060
Tare Container	29.542	29.423
Wt. Dry Soil	16.811	11.674
Moisture Content	41.943	43.344
Corrected for Blow Count	41.067	42.679
Liquid Limit Average	**41.9**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.636	12.862	12.497
Wt. Dry Worm + Tare	12.527	12.708	12.391
Wt. Water	0.109	0.154	0.106
Tare Container	11.558	11.509	11.457
Wt. Dry Worm	0.969	1.199	0.934
Moisture Content	11.249	12.844	11.349
Plastic Limit Average		**11.8**	

PLASTICITY INDEX (PI) = LL-PL **30.1**



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Parkland GEO

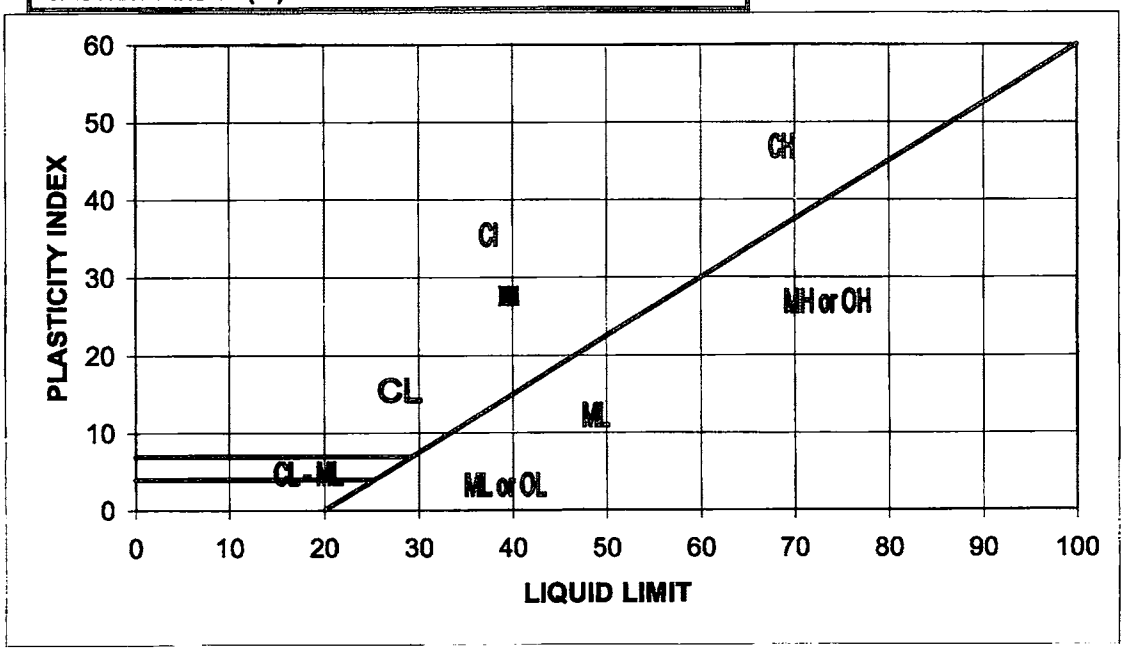
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 1
DEPTH 8.8m
SAMPLE # 1G8
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	24	25
Wt. Sample Wet + Tare	50.639	49.388
Wt. Sample Dry + Tare	44.577	43.763
Wt. Water	6.062	5.625
Tare Container	29.359	29.553
Wt. Dry Soil	15.218	14.210
Moisture Content	39.834	39.585
Corrected for Blow Count	39.638	39.585
Liquid Limit Average	**39.6**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	13.083	12.965	12.576
Wt. Dry Worm + Tare	12.925	12.829	12.464
Wt. Water	0.158	0.136	0.112
Tare Container	11.668	11.720	11.464
Wt. Dry Worm	1.257	1.109	1.000
Moisture Content	12.570	12.263	11.200
Plastic Limit Average		**12.0**	

PLASTICITY INDEX (PI) = LL-PL **27.6**



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Parkland GEO

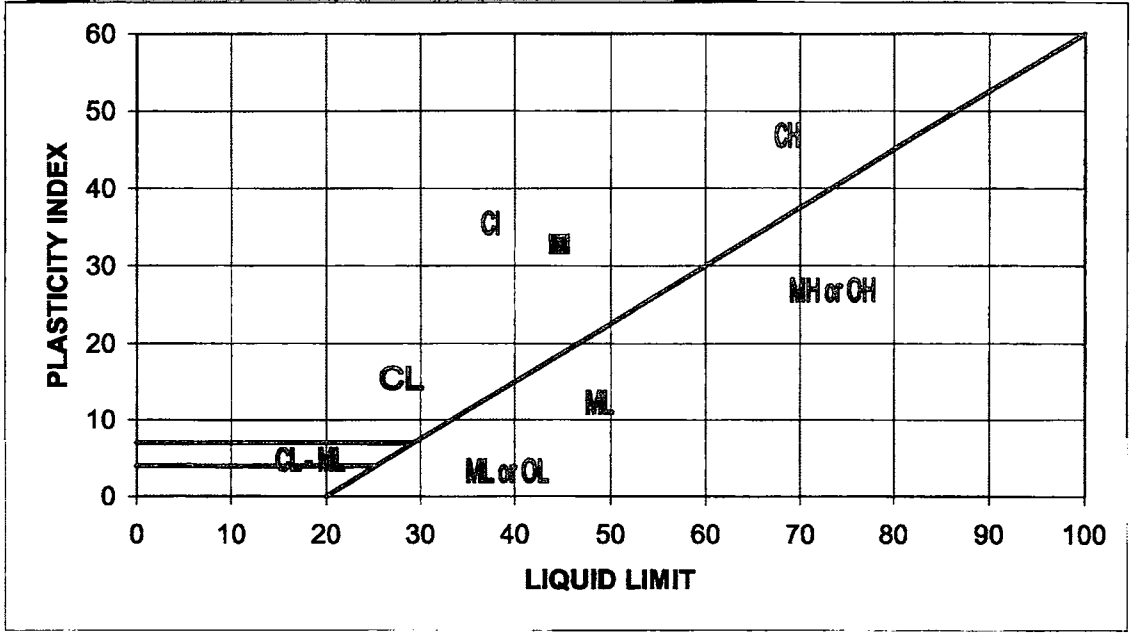
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 2
DEPTH 8.5m
SAMPLE # 2G6
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	29	30
Wt. Sample Wet + Tare	44.795	40.148
Wt. Sample Dry + Tare	39.892	36.852
Wt. Water	4.903	3.296
Tare Container	29.048	29.070
Wt. Dry Soil	10.844	7.782
Moisture Content	45.214	42.354
Corrected for Blow Count	46.033	43.299
Liquid Limit Average	**44.7**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	13.182	13.159	13.921
Wt. Dry Worm + Tare	13.000	12.983	13.665
Wt. Water	0.182	0.176	0.256
Tare Container	11.493	11.478	11.494
Wt. Dry Worm	1.507	1.505	2.171
Moisture Content	12.077	11.694	11.792
Plastic Limit Average		**11.9**	

PLASTICITY INDEX (PI) = LL-PL **32.8**



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Parkland GEO

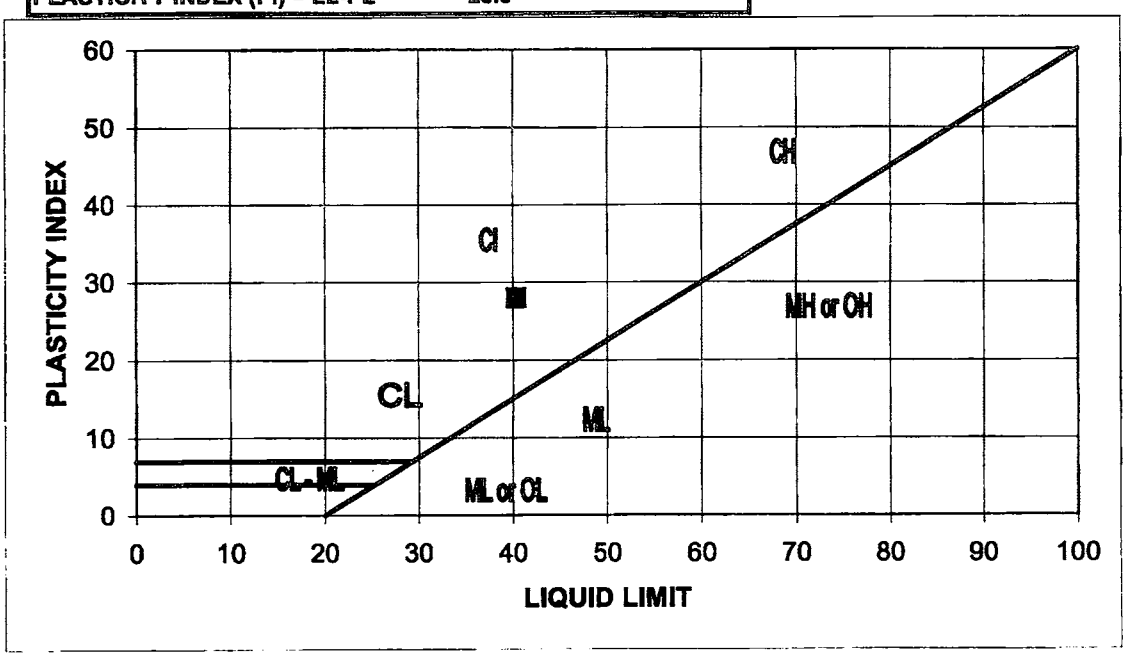
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 3
DEPTH 4.8m
SAMPLE # 3G4
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	22	23
Wt. Sample Wet + Tare	50.710	46.502
Wt. Sample Dry + Tare	44.603	41.668
Wt. Water	6.107	4.834
Tare Container	29.877	29.687
Wt. Dry Soil	14.726	11.981
Moisture Content	41.471	40.347
Corrected for Blow Count	40.834	39.942
Liquid Limit Average	**40.4**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.551	12.694	12.692
Wt. Dry Worm + Tare	12.438	12.572	12.567
Wt. Water	0.113	0.122	0.125
Tare Container	11.491	11.587	11.591
Wt. Dry Worm	0.947	0.985	0.976
Moisture Content	11.932	12.386	12.807
Plastic Limit Average		**12.4**	

PLASTICITY INDEX (PI) = LL-PL **28.0**



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Parkland GEO

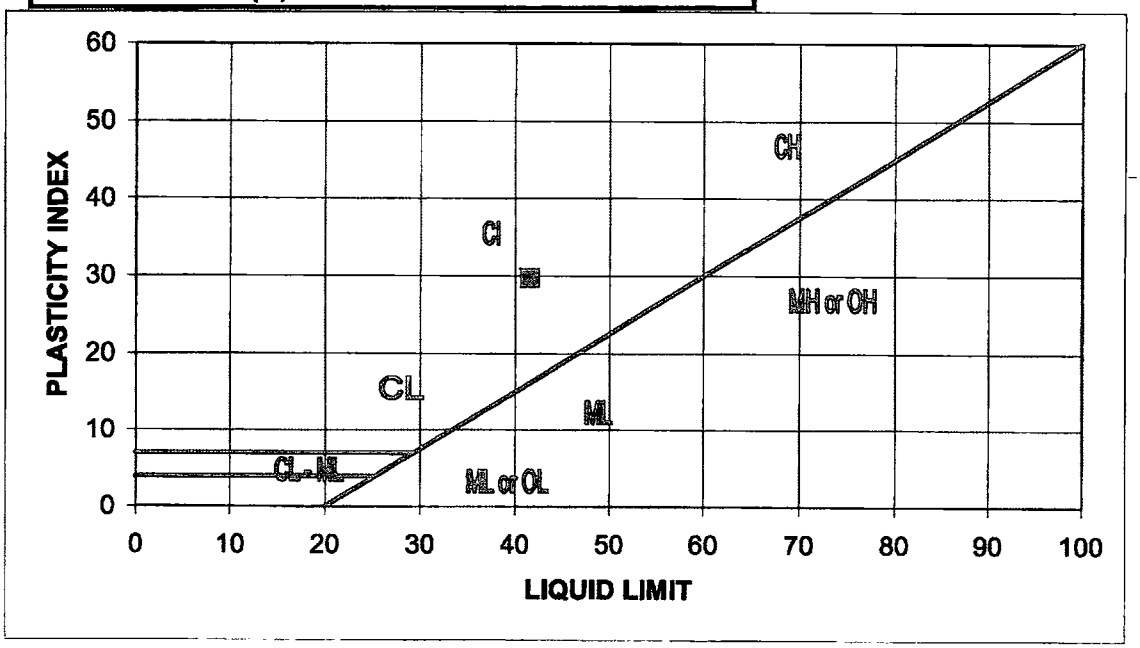
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 3
DEPTH 7.3m
SAMPLE # 3G6
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	27	28
Wt. Sample Wet + Tare	49.440	44.750
Wt. Sample Dry + Tare	43.560	40.200
Wt. Water	5.880	4.550
Tare Container	29.319	29.063
Wt. Dry Soil	14.241	11.137
Moisture Content	41.289	40.855
Corrected for Blow Count	41.676	41.419
Liquid Limit Average	**41.5**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.610	12.270	12.563
Wt. Dry Worm + Tare	12.498	12.203	12.454
Wt. Water	0.112	0.067	0.109
Tare Container	11.537	11.623	11.562
Wt. Dry Worm	0.961	0.580	0.892
Moisture Content	11.655	11.552	12.220
Plastic Limit Average		**11.8**	

PLASTICITY INDEX (PI) = LL-PL **29.7**



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Parkland GEO

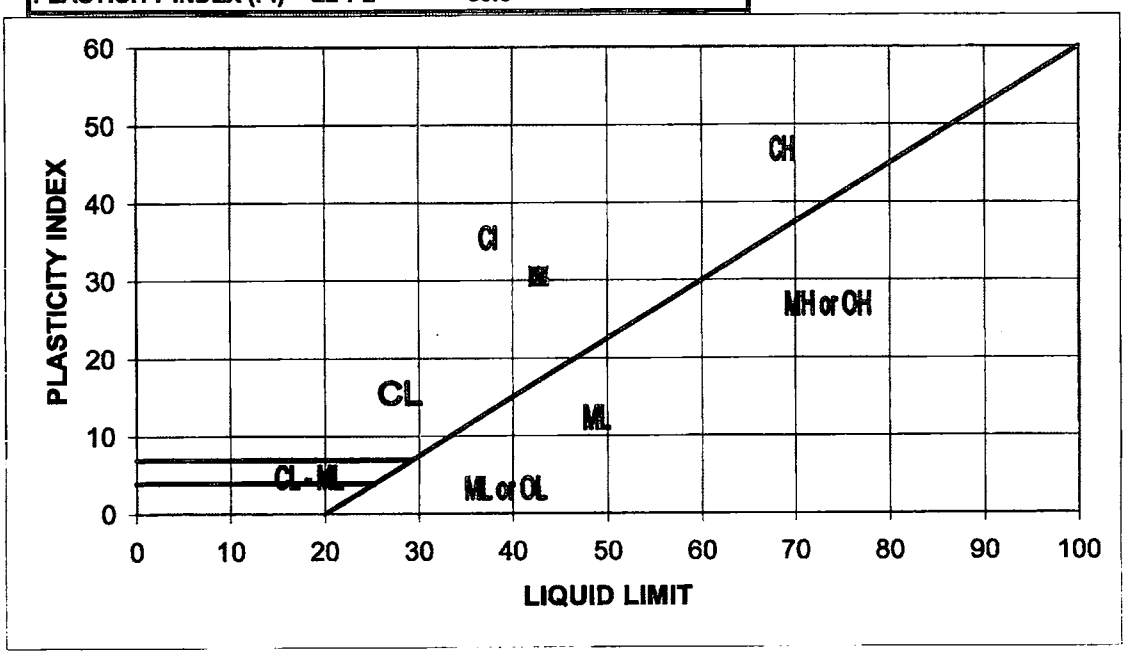
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 4
DEPTH 2.5m
SAMPLE # 4G3
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	20	21
Wt. Sample Wet + Tare	46.230	43.704
Wt. Sample Dry + Tare	41.067	39.195
Wt. Water	5.163	4.509
Tare Container	29.267	28.928
Wt. Dry Soil	11.800	10.267
Moisture Content	43.754	43.917
Corrected for Blow Count	42.589	43.001
Liquid Limit Average	**42.8**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.391	12.396	12.482
Wt. Dry Worm + Tare	12.293	12.308	12.376
Wt. Water	0.098	0.088	0.106
Tare Container	11.472	11.609	11.512
Wt. Dry Worm	0.821	0.699	0.864
Moisture Content	11.937	12.589	12.269
Plastic Limit Average		**12.3**	

PLASTICITY INDEX (PI) = LL-PL	**30.5**



Parkland GEO

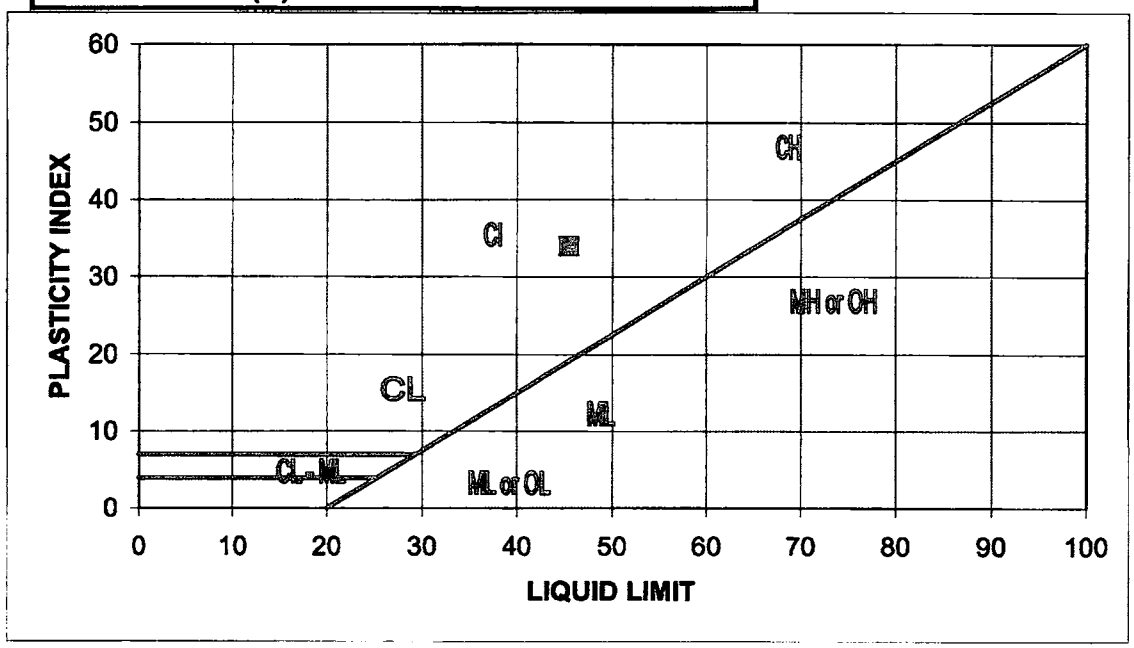
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 5
DEPTH 3.0m
SAMPLE # 5G3
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	25	26
Wt. Sample Wet + Tare	49.133	46.394
Wt. Sample Dry + Tare	42.916	40.980
Wt. Water	6.217	5.414
Tare Container	29.176	29.085
Wt. Dry Soil	13.740	11.895
Moisture Content	45.247	45.515
Corrected for Blow Count	45.247	45.731
Liquid Limit Average	**45.5**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.444	12.494	12.473
Wt. Dry Worm + Tare	12.363	12.380	12.383
Wt. Water	0.081	0.114	0.090
Tare Container	11.582	11.467	11.602
Wt. Dry Worm	0.781	0.913	0.781
Moisture Content	10.371	12.486	11.524
Plastic Limit Average		**11.5**	

PLASTICITY INDEX (PI) = LL-PL	**34.0**



Parkland GEO

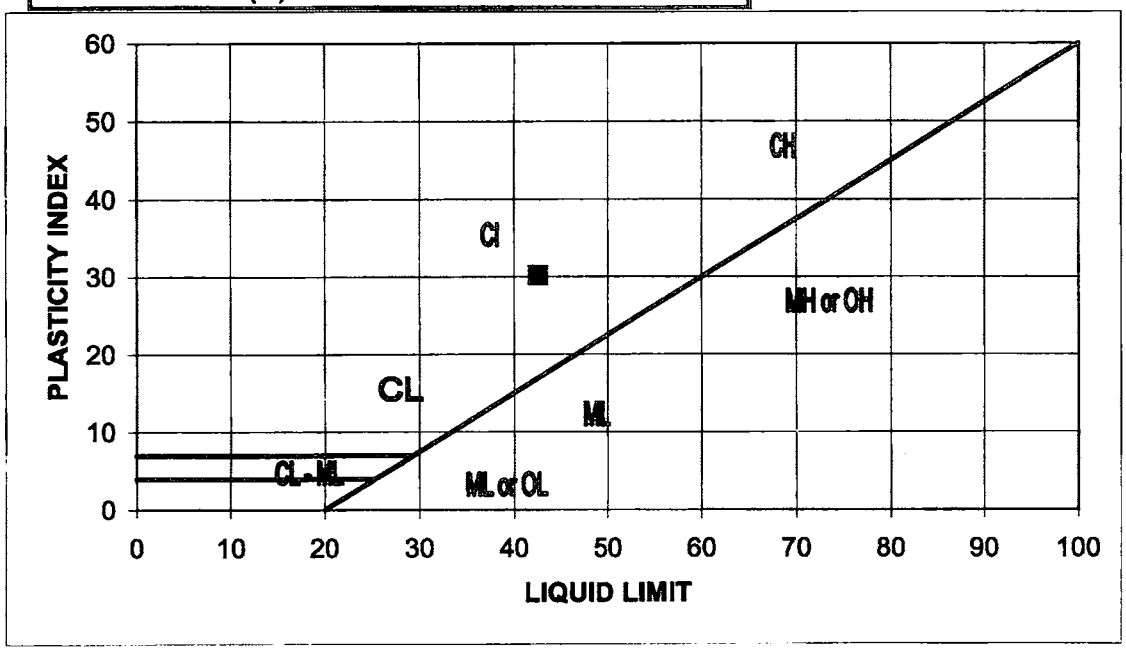
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 5
DEPTH 11.5m
SAMPLE # 5G8
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	21	22
Wt. Sample Wet + Tare	48.773	45.215
Wt. Sample Dry + Tare	42.753	40.403
Wt. Water	6.020	4.812
Tare Container	28.855	29.300
Wt. Dry Soil	13.898	11.103
Moisture Content	43.316	43.340
Corrected for Blow Count	42.411	42.674
Liquid Limit Average	**42.5**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.466	12.374	12.557
Wt. Dry Worm + Tare	12.369	12.287	12.441
Wt. Water	0.097	0.087	0.116
Tare Container	11.550	11.543	11.566
Wt. Dry Worm	0.819	0.744	0.875
Moisture Content	11.844	11.694	13.257
Plastic Limit Average		**12.3**	

PLASTICITY INDEX (PI) = LL-PL **30.3**



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Parkland GEO

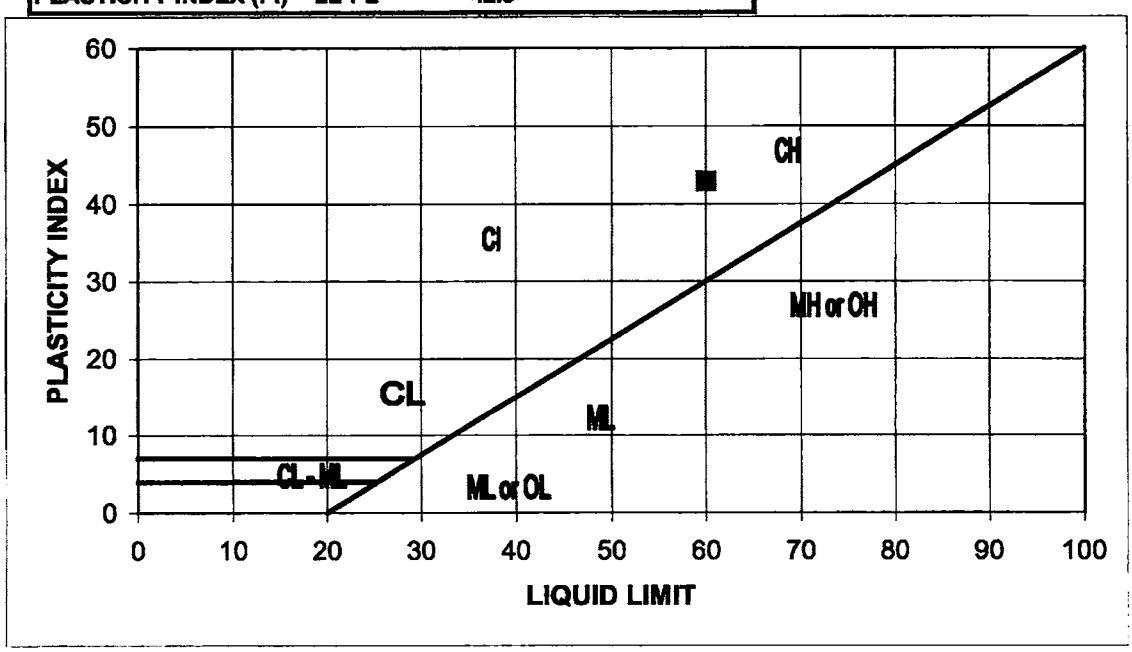
PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 1
DEPTH 1.0m
SAMPLE # 1G1
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	23	24
Wt. Sample Wet + Tare	44.139	45.160
Wt. Sample Dry + Tare	38.601	39.189
Wt. Water	5.538	5.971
Tare Container	29.457	29.296
Wt. Dry Soil	9.144	9.893
Moisture Content	60.564	60.356
Corrected for Blow Count	59.956	60.058
Liquid Limit Average	**60.0**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	13.047	12.903	13.002
Wt. Dry Worm + Tare	12.839	12.690	12.821
Wt. Water	0.208	0.213	0.181
Tare Container	11.661	11.466	11.700
Wt. Dry Worm	1.178	1.224	1.121
Moisture Content	17.657	17.402	16.146
Plastic Limit Average		**17.1**	

PLASTICITY INDEX (PI) = LL-PL	**42.9**



Parkland GEO

PROJECT# GP1758
PROJECT Homeland Hutterian Colony - Lagoon
BOREHOLE 3
DEPTH 0.9m
SAMPLE # 3G1
DATE 22-Jul-10
TECH

SOIL PLASTICITY SUMMARY

LIQUID LIMIT (LL)		
Trial No.	1	2
No. Blows	26	27
Wt. Sample Wet + Tare	43.946	44.216
Wt. Sample Dry + Tare	38.300	38.202
Wt. Water	5.646	6.014
Tare Container	29.368	29.074
Wt. Dry Soil	8.932	9.128
Moisture Content	63.211	65.885
Corrected for Blow Count	63.512	66.502
Liquid Limit Average	**65.0**	

PLASTIC LIMIT (PL)			
Trial No.	1	2	3
Wt. Wet Worm + Tare	12.828	12.854	12.865
Wt. Dry Worm + Tare	12.594	12.640	12.703
Wt. Water	0.234	0.214	0.162
Tare Container	11.401	11.528	11.623
Wt. Dry Worm	1.193	1.112	1.080
Moisture Content	19.614	19.245	15.000
Plastic Limit Average		**18.0**	

PLASTICITY INDEX (PI) = LL-PL	**47.1**

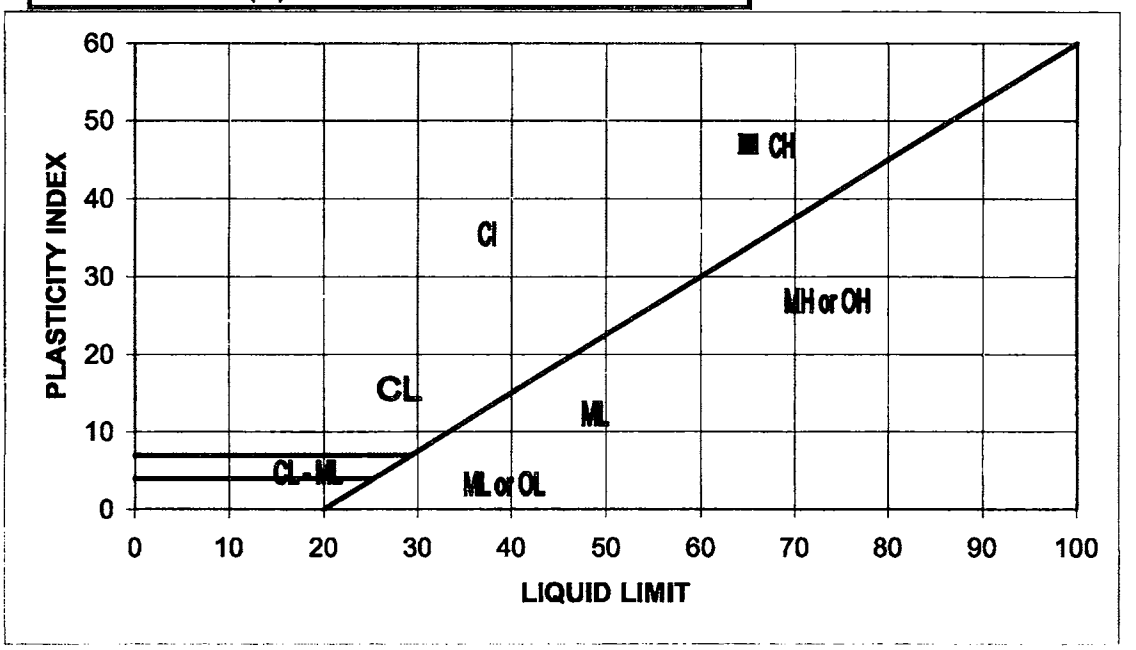


TABLE: 1

TITLE: **SOIL ANALYSES - DOMESTIC USE AQUIFER ASSESSMENT USING DRAWDOWN**

PROJECT#: GP1758
CLIENT: Focus Corp.
PROJECT: Sewage Lagoon
SITE: Homeland Hutterian Colony
LOCATION: Homeland Hutterian Colony

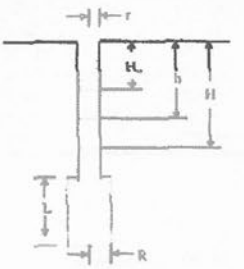
CRITERIA: ALBERTA TIER 2 SOIL AND GROUNDWATER REMEDIATION GUIDELINES, FEBRUARY 2009

REFERENCE: APPENDIX E: DOMESTIC USE AQUIFER
HVORSLEV'S METHOD
FARVOLDEN METHOD FOR SUSTAINED YIELD

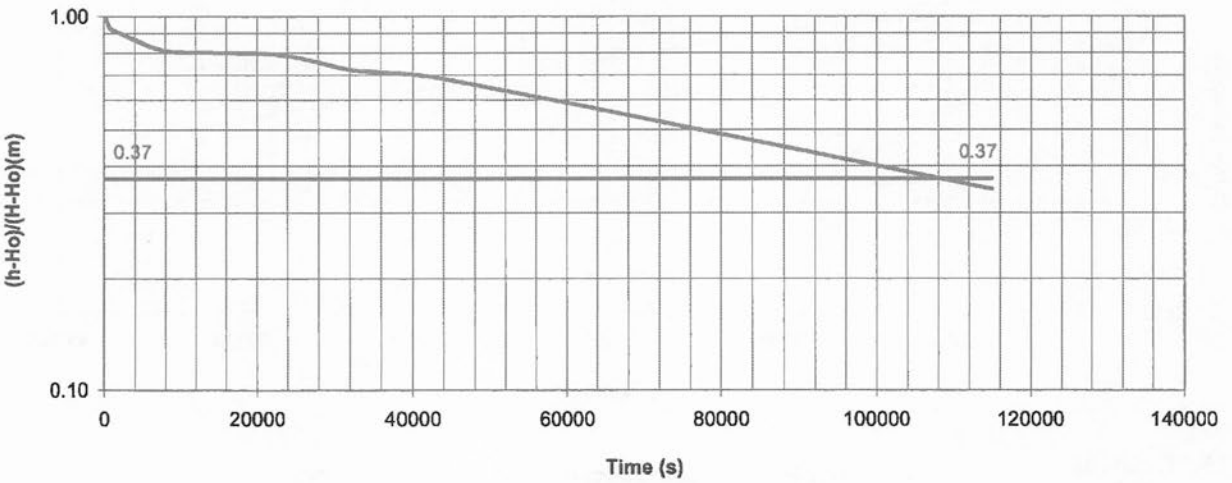
1. Bulk Hydraulic Conductivity using Slug Test

Date of Slug Test:	28-Jul-10	Monitoring Well #	BH3
Radius of Well Casing, r (cm):	2.54	Static Water Level, Ho (m BGL):	6.77
Radius of Borehole, R (cm):	7.62	Water Level at Start of Test, H (m BGL):	8.01
Length of Well Screen, L (cm):	300	Duration of Test, T (s):	115000
Depth of Well (cm):	829	Time Required for 37% Recovery From Graph 1, To (s):	106000

Time (sec)	h (mBGL)	h-Ho (m)	H-Ho (m)	(h-Ho)/(H-Ho) (m)
240	8.01	1.24	1.24	1.00
660	7.94	1.17	1.24	0.94
1020	7.915	1.145	1.24	0.92
4260	7.84	1.07	1.24	0.86
8880	7.77	1	1.24	0.81
22980	7.75	0.98	1.24	0.79
32820	7.66	0.89	1.24	0.72
45000	7.61	0.84	1.24	0.68
115000	7.2	0.43	1.24	0.35



Graph 1: Hvoslev Slug Test Results



$$K = \frac{r^2 \ln(L/R)}{2LTo}$$

Bulk Hydraulic Conductivity (K) = 3.73E-07 cm/s
3.73E-09 m/s

TABLE: 1

TITLE: SOIL ANALYSES - DOMESTIC USE AQUIFER ASSESSMENT USING DRAWDOWN

PROJECT#: GP1758
CLIENT: Focus Corp.
PROJECT: Sewage Lagoon
SITE: Homeland Hutterian Colony
LOCATION: Homeland Hutterian Colony

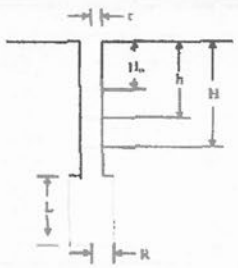
CRITERIA: ALBERTA TIER 2 SOIL AND GROUNDWATER REMEDIATION GUIDELINES, FEBRUARY 2009

REFERENCE: APPENDIX E: DOMESTIC USE AQUIFER
HVORSLEV'S METHOD
FARVOLDEN METHOD FOR SUSTAINED YIELD

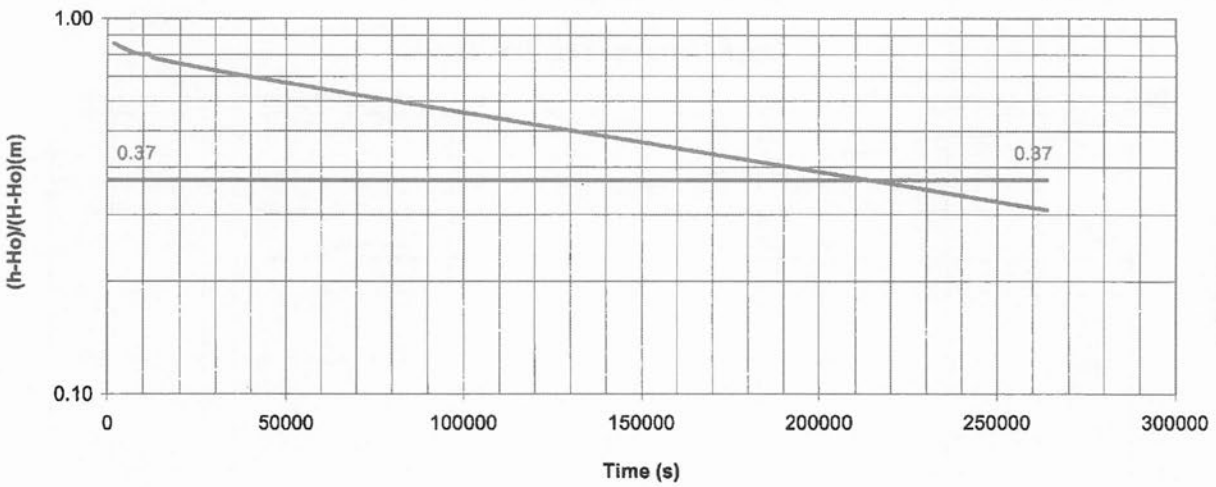
1. Bulk Hydraulic Conductivity using Slug Test

Date of Slug Test:	6-Aug-10	Monitoring Well #	BH4
Radius of Well Casing, r (cm):	2.54	Static Water Level, Ho (m BGL):	9.47
Radius of Borehole, R (cm):	7.62	Water Level at Start of Test, H (m BGL):	10.54
Length of Well Screen, L (cm):	300	Duration of Test, T (s):	264000
Depth of Well (cm):	1064	Time Required for 37% Recovery From Graph 1, To (s):	210000

Time (sec)	h (mBGL)	h-Ho (m)	H-Ho (m)	(h-Ho)/(H-Ho) (m)
1980	10.385	0.915	1.07	0.86
7320	10.335	0.865	1.07	0.81
11580	10.325	0.855	1.07	0.80
13080	10.305	0.835	1.07	0.78
34920	10.23	0.76	1.07	0.71
264000	9.8	0.33	1.07	0.31



Graph 1: Hvoslev Slug Test Results



$$K = \frac{r^2 \ln(L/R)}{2LTo}$$

Bulk Hydraulic Conductivity (K) = 1.88E-07 cm/s
1.88E-09 m/s

TRIAXIAL HYDRAULIC CONDUCTIVITY TEST

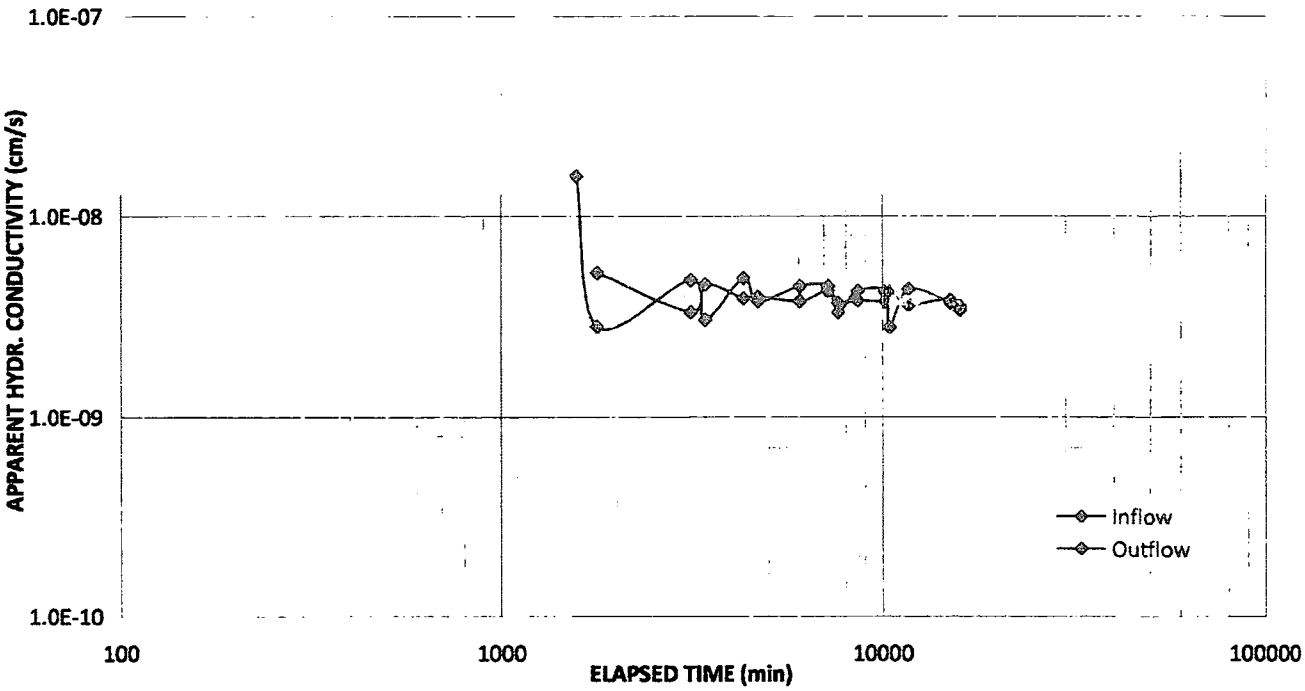
ASTM METHOD D5084

Project: Proposed Sewage Lagoon
Project #: GP1758
Client: Homeland Hutterite Colony

Sample #: 1U1
Sample Type: Tube
Date: July 25-10

Soil Type: Clay Till

Initial Height:	29.7	mm	Final Height:	29.7	mm
Initial Diameter:	72.9	mm	Final Diameter:	73.3	mm
Initial Water Content:	15.0	%	Final Water Content:	16.7	%
Initial Compaction:		%	Average Confining Pressure:	13.96	kPa
Initial Dry Density:	1.88	Mg/m^3	Average Hydraulic Gradient:	47.18	



COEFFICIENT OF PERMEABILITY K= 3.5E-09 cm/s @ 15845 minutes

Tech AT

Checked

LIMITATIONS

REPORT LIMITATIONS AND USAGE

THIS AGREEMENT IS ENTERED INTO this 15 day of July, 2010 between The Twilight Hutterian Colony "CLIENT" and PARKLAND GEOTECHNICAL LTD., hereinafter referred to as "CONSULTANT".

WHEREAS CLIENT desires CONSULTANT to perform certain technical services, the CLIENT and CONSULTANT have agreed that such services shall be performed in accordance with the terms and conditions set forth herein.

THE PARTIES HERETO AGREE AS FOLLOWS:

1. STANDARD OF CARE - In the performance of professional services, the CONSULTANT will use that degree of care and skill ordinarily exercised under similar circumstances by reputable members of its profession practicing in the same or similar localities. No other warranty expressed or implied is made or intended by this agreement or by furnishing oral or written reports of the findings made. The CONSULTANT is to be liable only for damage directly caused by the negligence of the CONSULTANT. The CLIENT recognizes that subsurface conditions will vary from those encountered at the location where borings, surveys, or explorations are made and that the data, interpretations and recommendation of the CONSULTANT are based solely on the information available to him. Classification and identification of soils, rocks, geological units, contaminated materials and contaminant quantities will be based on commonly accepted practices in geotechnical consulting practice in this area. The CONSULTANT will not be responsible for the interpretation by others of the information developed.

2. SITE INFORMATION - The CLIENT agrees to fully cooperate with the CONSULTANT and provide all information with respect to the past, present and proposed conditions and use of the Site whether specifically requested or not. The CLIENT acknowledges that in order for the CONSULTANT to properly advise and assist the CLIENT in respect of the investigation of the Site, the CONSULTANT is relying upon full disclosure by the CLIENT of all matters pertinent to an investigation of the Site.

   Where specifically stated in the scope of work, the CONSULTANT will perform a review of the historical information obtained or provided by the Client to assist in the investigation of the Site unless and except to the extent that such a review is limited or excluded from the scope of work.

3. DELAYS AND INTERRUPTIONS - Should the CONSULTANT be delayed or interrupted by others in the performance of its services or be required to perform additional services as a result of any delay or interruption caused by others, the CONSULTANT shall be equitably compensated by the CLIENT for all costs, charges and expenses which it may incur resulting from such delay or interruption.

4. RIGHT OF ENTRY - The CLIENT is responsible for ensuring that the CONSULTANT is provided unencumbered access to the property to the extent necessary for the CONSULTANT to complete the scope of work to CONSULTANT's satisfaction. The CLIENT is solely responsible for obtaining permission and permits for the CONSULTANT to enter onto the subject site, including informing tenants. The CLIENT shall also provide the CONSULTANT with the location of all underground utilities and structures on the subject site, unless otherwise agreed to in writing. While the CONSULTANT will take all reasonable precautions to avoid and minimize any damage to any sub-terrain utilities or structures, the CLIENT agrees to hold the CONSULTANT harmless for any damage to any sub-terrain utilities or structures or any damage occasioned in gaining access to the subject site.

5. COMPLETE REPORT - The Report is of a summary nature and is not intended to stand alone without reference to the instructions given to the CONSULTANT by the CLIENT, communications between the CONSULTANT and the CLIENT, and to any other reports, writings or documents prepared by the CONSULTANT for the CLIENT relative to the specific Site, all of which constitute the Report. The word "Report" shall refer to any and all of the documents referred to herein. In order to properly understand the suggestions, recommendations and opinions expressed by the CONSULTANT, reference must be made to the whole of the Report. The CONSULTANT cannot be responsible for

use of any part or portions of the report without reference to the whole report. The CLIENT agrees that any and all reports prepared by the CONSULTANT shall contain the following statement:

> "This report has been prepared for the exclusive use of (CLIENT NAME). Any use which a third party makes of this report, or any reliance on or decisions to be made based on it, are the responsibility of such third parties. PARKLAND GEOTECHNICAL LTD. accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions based on this report."

The CLIENT agrees that in the event that any such report is released to a third party, such disclaimer shall not be obliterated or altered in any manner. The CLIENT further agrees that all such reports shall be used solely for the purposes of the CLIENT and shall not be released or used by others without the prior written permission of the CONSULTANT.

6. LIMITATIONS ON SCOPE OF INVESTIGATION AND WARRANTY DISCLAIMER
There is no warranty, expressed or implied, by the CONSULTANT that:
   a) the investigation shall uncover all potential contaminants or environmental liabilities on the Site; or
   b) the Site will be entirely free of all contaminants as a result of any investigation or cleanup work undertaken on the Site, since it is not possible, even with exhaustive sampling, testing and analysis, to document all potential contaminants on the Site.

   The CLIENT acknowledges that:
   a) the investigation findings are based solely on the information generated as a result of the specific scope of the investigation authorized by the CLIENT;
   b) unless specifically stated in the agreed Scope of Work, the investigation will not, nor is it intended to assess or detect potential contaminants or environmental liabilities on the Site;
   c) any assessment regarding geological conditions on the Site is based on the interpretation of conditions determined at specific sampling locations and depths and that conditions may vary between sampling locations, hence there can be no assurance that undetected geological conditions, including soils or groundwater are not located on the Site;
   d) any assessment is also dependent on and limited by the accuracy of the analytical data generated by the sample analyses;
   e) any assessment is also limited by the scientific possibility of determining the presence of unsuitable geological conditions for which scientific analyses have been conducted; and
   f) the analytical parameters selected are limited to those outlined in the CLIENT's authorized scope of investigation; and
   g) there are risks associated with the discovery of hazardous materials in and upon the lands and premises which may inadvertently discovered as part of this investigation. The CLIENT acknowledges that it may have a responsibility in law to inform the owner of any affected property of the existence or suspected existence of hazardous materials. The CLIENT further acknowledges that any such discovery may result in the fair market value of the lands and premises and of any other lands and premises adjacent thereto to be adversely affected in a material respect.

7. COST ESTIMATES - Estimates of remediation or construction costs can only be based on the specific information generated and the technical limitations of the investigation authorized by the CLIENT. Accordingly, estimated costs for construction are based on the known site conditions, which can vary as new information is discovered during construction. As some construction activities are an iterative exercise, the CONSULTANT shall therefore not be liable for the accuracy of any estimates of remediation or construction costs provided.

8. CONTROL OF WORK SITE AND JOBSITE SAFETY - The CONSULTANT is only responsible for the activities of its employees on the jobsite. The presence of the CONSULTANT personnel on the Site shall not be construed in any way to relieve the CLIENT or any contractors on Site from their responsibilities for Site safety. The CLIENT undertakes to inform the CONSULTANT of all hazardous

conditions, or possible hazardous conditions which are known to him. The CLIENT also recognizes that the activities of the CONSULTANT may uncover previously unknown hazardous materials and that such a discovery may result in the necessity to undertake emergency procedures to protect the CONSULTANT employees as well as the public at large and the environment in general. The CLIENT also acknowledges that in some cases the discovery of hazardous conditions and materials will require that certain regulatory bodies be informed and the CLIENT agrees that notification to such bodies by the CONSULTANT will not be a cause of action or dispute.

9. LIMITATION OF RESPONSIBILITY

LIMITATION OF LIABILITY - The CLIENT hereby agrees that to the fullest extent permitted by the law the CONSULTANT's total liability to CLIENT for any and all injuries, claims, losses, expenses or damages whatsoever arising out of or in anyway relating to the Project, the Site, or this agreement from any cause or causes including but not limited to the CONSULTANT's negligence, errors, omissions, strict liability, breach of contract, or breach of warranty shall not exceed the total amount paid by the CLIENT for the services of the CONSULTANT under this contract or $50,000, whichever is greater.

NO SPECIAL OR CONSEQUENTIAL DAMAGES - The CLIENT and CONSULTANT agree that to the fullest extent permitted by law the CONSULTANT shall not be liable to the CLIENT for any special, indirect or consequential damages whatsoever, whether caused by the CONSULTANT's negligence, errors, omissions, strict liability, breach of contract, breach of warranty or other cause of causes whatsoever.

INDEMNIFICATION - To the fullest extent permitted by law, the CLIENT agrees to defend, indemnify and hold the CONSULTANT, its directors, officers, employees, agents and subcontractors, harmless from and against any and all claims, defence costs, including legal fees on a full indemnity basis, damages, and other liabilities arising out of or in any way related to the CONSULTANT's reports or recommendations concerning this Agreement, the CONSULTANT's work and presence on the project property, or the presence, release, or threatened release of hazardous substances or pollutants on or from the Site; provided that the CLIENT shall not indemnify the CONSULTANT against liability for damages to the extent caused by the negligence or intentional misconduct of the CONSULTANT, its agents or subcontractors.

10. FINANCIAL CONTRACTUAL TERMS - The CONSULTANT will submit monthly invoices to the CLIENT and a final bill upon completion of the work. Payment is due upon presentation of invoice and is past due thirty (30) days from the date the invoice is received. No holdbacks will apply to the fees earned herein or to third party billings associated with the CONSULTANT's work. The CLIENT agrees to pay a finance charge of one and one-half percent (1-1/2%) per month (which is equivalent to an annual rate of interest, compounded monthly, of 19.56%) on past due accounts. If payment remains past due forty-five (45) days from the date the invoice is sent, then the CONSULTANT shall have the right to suspend all work under this Agreement, without prejudice, and all reasonable demobilization and other suspension costs will be paid by CLIENT. The CLIENT agrees that any collection fees, including consultant, agency, legal fees on a full indemnity basis and court fees, incurred by the CONSULTANT shall be payable over and above the contract amount.

11. EXTENT OF AGREEMENT - This Agreement represents the entire Agreement between the CLIENT and the CONSULTANT and supercedes any and all prior negotiations, representations, or agreements, either written or oral. Work beyond the scope of services or re-doing any part of the services through no fault of the CONSULTANT, shall constitute extra work and shall be paid for by the CLIENT on a "time and materials" basis in addition to any other payment provided for in this Agreement.

12. DISPUTES - Any dispute arising hereunder shall first be resolved by taking the following steps, where a successive step is taken if the issue is not resolved at the preceding step: 1) by technical and contractual personnel for each party performing this Subcontract, 2) by executive management of

each party, 3) by mediation, 4) by arbitration if both parties agree, or 5) through the court system of the jurisdiction of the CONSULTANT office that entered this Agreement.

13. TERMINATION - This Agreement may be terminated by the CONSULTANT for any reason whatsoever upon ten (10) days written notice supplied by the CONSULTANT to the CLIENT. In the event that this Agreement is terminated by the CONSULTANT, the CLIENT shall pay the CONSULTANT for all work performed by the CONSULTANT and any de-mobilization charges by the CONSULTANT incurred to the date of the notice of termination of the Agreement.

IN WITNESS WHEREOF the parties have caused this Agreement to be signed, as of the date and year first set forth below in the City of Grande Prairie, Alberta:

FOR THE CONSULTANT:

Consultant:	Parkland Geotechnical Ltd.
Signature:	Neal Maloney
Print Name:	Neal Maloney, C.Tech
Title:	Office Manager
Date:	July 14, 2010

FOR THE CLIENT:

Client:	The Twilight Hutterian Colony
Signature:	
Print Name:	
Title:	
Date:	

Please execute this agreement and return the last page by fax, e-mail (pdf), or courier to:

ParklandGEO
#4, 10902 - 92 Ave
Grande Prairie, Alberta
T8V 6B5

Phone: 780 / 539 - 5102
Fax: 780 / 539 - 5106

*REFERENCE: Project Number: **PRO-GP10-068**